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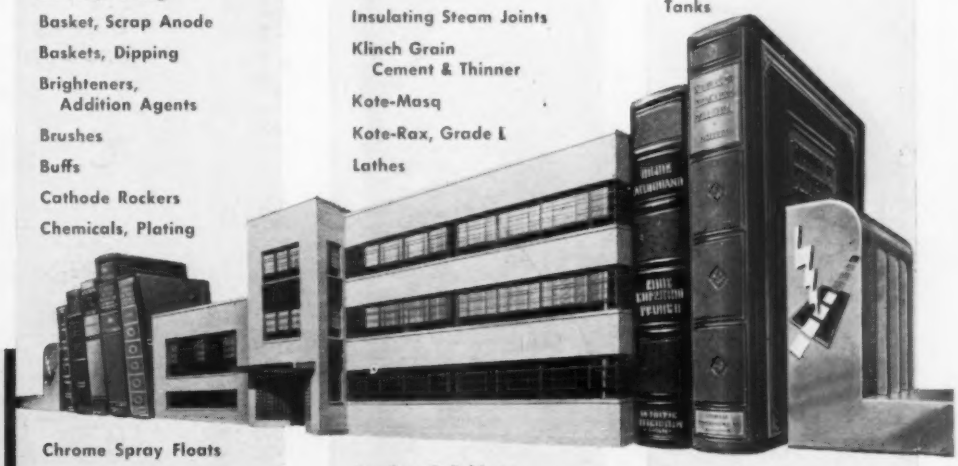

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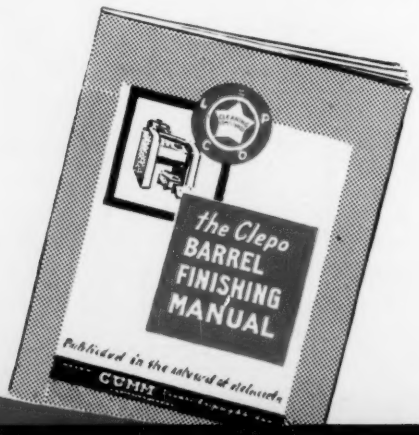

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CONTENTS

Editorial 59

Treatment of Chromium and Other Plating Room Waste Waters 60
By Milton E. Hodges

Sequestering Agents in Aluminum Etching 65
By Francis J. Prescott, John K. Shaw and Jay Lilker

Electroplating on Beryllium 68
By John G. Beach and Charles L. Faust

Washing Dollars Out of Deburring 71
By Gordon B. Ashmead

National Metal Show and Congress 74

104th Meeting of the Electrochemical Society 75

How One Firm Beat the Nickel Shortage 78

Abstracts from the World's Plating Literature 81

Shop Problems 84

Patents 86

Recent Developments 90

Manufacturers' Literature 98

News from California 102

Associations and Societies 104

Business Items 109

Obituaries 123

Motor City Plating News 124

New Book 128

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A method for determining the metal content in phosphating baths by means of a cation exchanger in the hydrogen form.

Description of experiments made to determine why parallel grooves are formed on soluble anodes during electrolysis.

Factors and methods involved in the cleaning of fine instrument equipment containing bimetallic clockwork components.

A description of the work done to attempt to evolve a substitute for the commercial cyanide bath used in the electrodeposition of copper.

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METAL FINISHING

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A Mad Scramble Again?

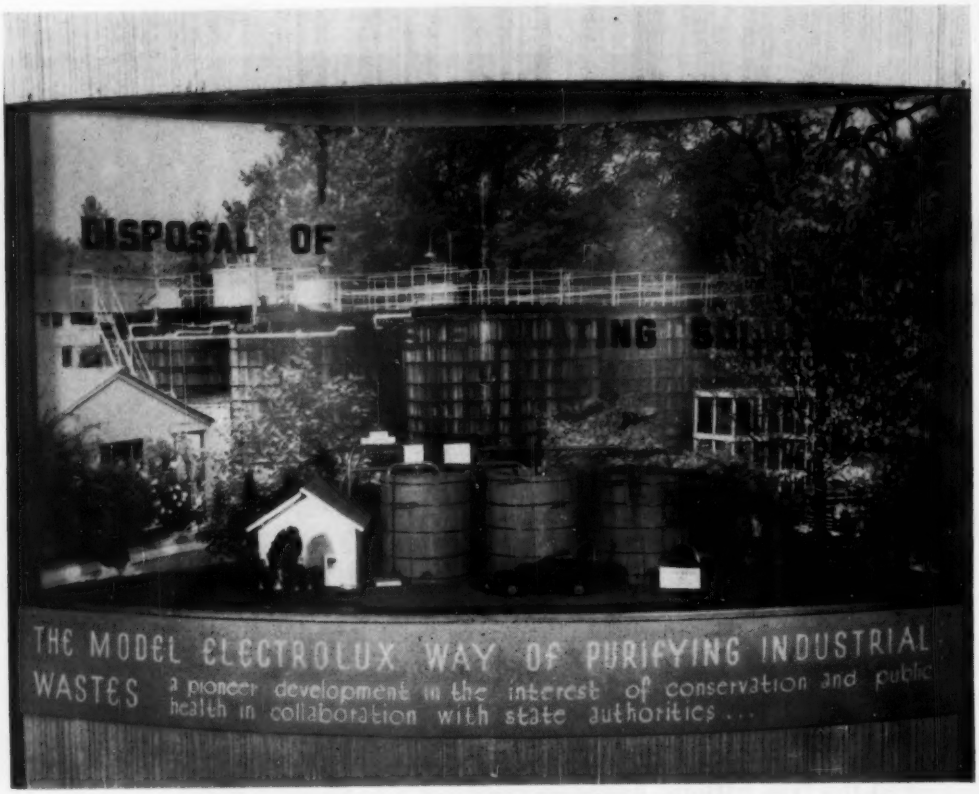
During the past few weeks many rumors have been broadcast concerning the nickel situation but, as we go to press, only a few definite facts have been confirmed.

The International Materials Conference, consisting of representatives from most of the free nations, has been responsible for distribution of nickel among these countries in such manner that the defense effort would be accelerated. On August 17th the Conference signaled its own end with an announcement that international allocation of nickel would cease after September. A few days earlier, the Industry Advisory Committee of Primary Consumers of Nickel for Chemicals and Electroplating recommended, at a meeting with NPA, that all government controls on the civilian use of nickel be removed as soon as possible.

Although the Government has been considering removal of *all* controls, which would throw the matter back into industry's lap, it must be recognized that all this has no effect at all on available supplies of the metal. With defense agencies currently taking about 40 per cent, exclusive of stockpile requirements, nickel platers will still face a precarious existence.

Since complete removal of allocations would probably result in a rat-race, with favored users and black-marketeers profiting at the expense of the small operator, we sincerely hope that allocations of nickel will remain in full force until such time as the steadily increasing production begins to approach the demand or until Government requirements begin to taper off. However, some relief must be accorded the plating industry and we believe that this can be best accomplished by amending Nickel Order M-80 so that *all* nickel platers may receive their share of the metal, to be used without restriction as to the type of article plated and the thickness of deposit applied. Only in this way can manufacturers fight the competition from foreign sources, which are not subject to such restrictions.

Nathaniel Hall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Miniature model of the waste water treatment plant.

Treatment of Chromium and Other Plating Room Waste Waters

By Milton E. Hodges, *Plant Engineer, Electrolux Corporation, Old Greenwich, Conn.*

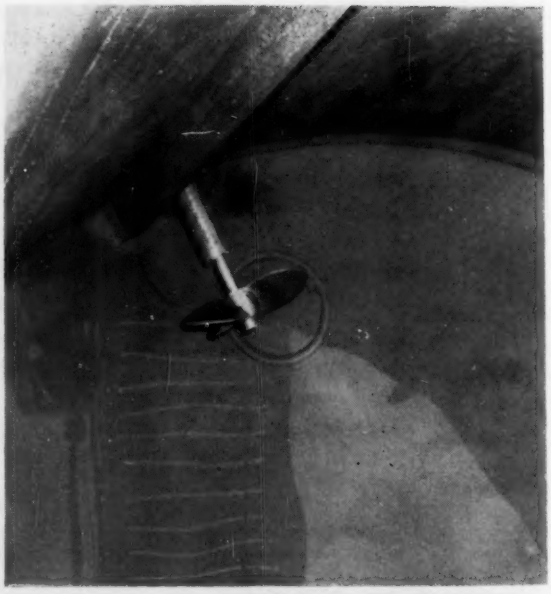
Introduction

MANY articles have been written and a great deal of research has been done on the subject of plating waste water treatment in recent years. This has been stimulated by the passage of laws giving local, state and federal agencies the authority to require industry to treat their wastes. Some industries early recognized the necessity of caring for their waste waters, and this article will deal with the experiences that we, at the Electrolux Corporation plant in Old Greenwich, Connecticut, have had with plating room waste treatment for the past fourteen years.

Early Studies

A large plating department is operated at the Electrolux plant, and this includes chromium, nickel, cadmium, copper and zinc plating. Chromium and nickel are by far the largest operations. Cyanides are used to a minor degree.

In 1939, the Electrolux Corp. in cooperation with the Connecticut State Water Commission pioneered in the development of a waste water treatment plant. Prior to



The stainless steel propeller of the agitator in the bottom of a reaction tank.

Chemicals are added manually to a full retention tank.

this, there was little published information on plating room wastes. Preliminary research had been conducted by Wesleyan University and the State Water Commission to study methods of eliminating toxic metals, of which the chief one was hexavalent chromium, to remove cyanides, and to reduce the color of the waste water. The original treatment plant at Electrolux was one of the earliest industrial applications of the principles developed in these researches. It consisted of a small steel building which housed the necessary pumping equipment, and provided storage for chemicals, had a small laboratory, two small chemical mixing tanks, and filter press for the sludge. Outside the building, a concrete retention pit with pumps and float was built and two 20,000 gallon redwood treatment tanks were erected.

At that time, of the several chemicals studied, it was decided to use barium sulfide and sulfuric acid for the accomplishment of the treatment. The waste water flows by gravity to the retention pit from where it was pumped into the 20,000 gallon reaction tanks. A sample was then taken from the reaction tank to determine the amount of sulfuric acid required to reduce the pH to approximately 2.0 and to determine the amount of barium sulfide required to reduce the chromium. The sulfuric acid was then added to the waste water in the reaction tank and the pH lowered, then the barium sulfide was added and thoroughly mixed into the solution with an agitator for approximately two hours. Hydrated lime was then added and mixed until the pH had been raised to slightly higher than 7.0. The precipitate was allowed to settle one hour, after which the clear supernatant water was decanted by means of an adjustable standpipe in the bottom of the tank. The reaction between barium sulfide and chromic acid may be represented as follows:

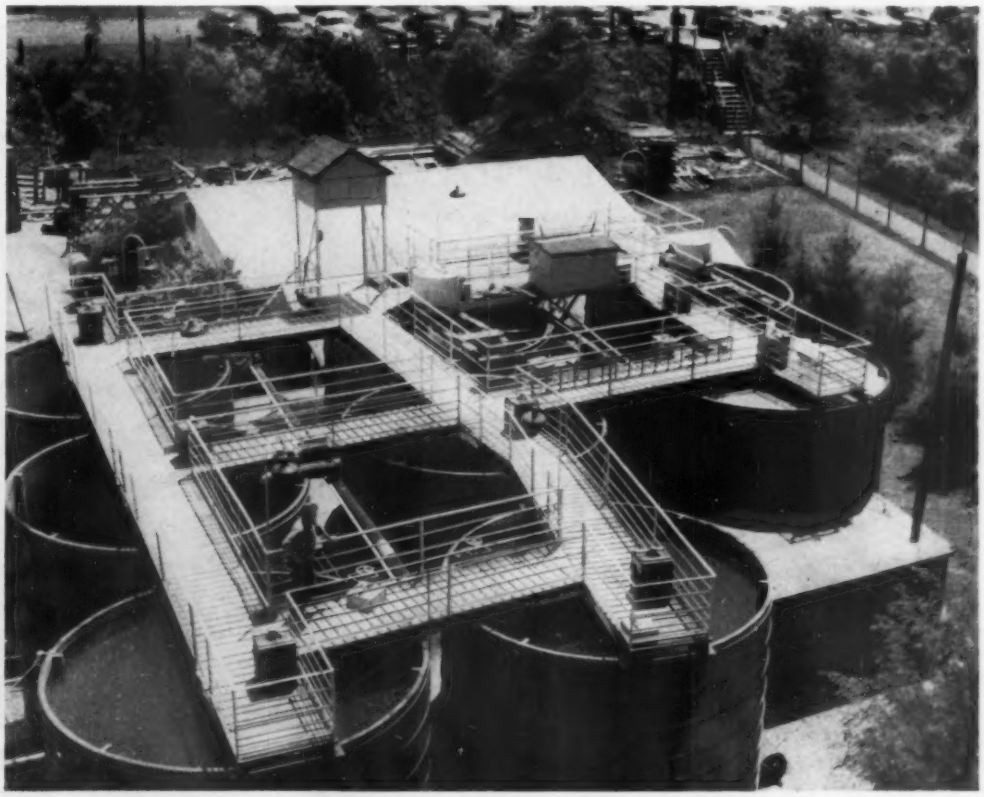
$$BaS + CrO_3 + H_2O \rightarrow BaCrO_4 + H_2S \text{ and}$$
$$BaS + H_2Cr_2O_7 \rightarrow BaCr_2O_7 + H_2S$$

Both barium chromate and barium dichromate were formed.

The sludge was removed by pumping it to a filter press and disposing of the filter-cake to ash cans, which were hauled to a dumping ground. It was found that with a waste water containing 75 ppm of chromium good results were obtained by reducing the pH to 2.0 and then adding 5 to 6 pounds of barium sulfide per 1,000 gallons. About 4 pounds of lime per 1,000 gallons were needed to raise the pH to 7.0.

Treatment Difficulties

Barium sulfide was effective, but certain difficulties were encountered. The black ash of commercial barium sulfide is coarse and tests about 80% purity. It is difficult to dissolve and it was found necessary to grind it through an 80 mesh screen. This was a very dirty job and an enclosed room with an exhaust system had to be provided to keep the black dust from covering surrounding equipment and the plant area. Controlling the dirt was almost an impossibility since it had to be handled from the grinder to the dissolving tanks. Hot water



View of treatment plant showing catwalks.

Waste water treatment plant landscaped to eliminate an unattractive appearance.

at a temperature of about 65°C. was needed to dissolve the sulfide and a 30% solution was used. In this operation, some loss of hydrogen sulfide occurred due to hydrolysis of the chemical. The odor of hydrogen sulfide was present much of the time and created unpleasant conditions in the waste treatment plant. At times, a black colloidal precipitate appeared in the top water in the settling tanks, possibly due to other metals, such as iron, copper or nickel being present. Supplemental treatment with other reducing agents was occasionally necessary for complete removal of hexavalent chromium. Another difficulty encountered with the barium sulfide was due to small portions of barium sulfide escaping through the decanting pipe and lodging in the storm sewer. On rare occasions, if the pH of the supernatant liquid being discharged was slightly under 7.0, it caused hydrogen sulfide to be evolved from the storm drain, emitting a very disagreeable odor.

These difficulties as well as a desire to find better and more economical treating agents has led to experiments with a number of reducing chemicals. Ferrous sulfate (copperas) was tried in place of the barium sulfide. It overcame the dust and odor nuisance, but there was difficulty in reducing chromium when the waste contained over 100 parts per million of hexavalent chromium. Copperas doses were much higher than barium sulfide doses, and a greater volume of sludge, up to 22 per cent, resulted. It was necessary to raise the pH well above 8.0 to precipitate all of the ferric hydroxide with the chromic hydroxide, and failure to obtain a high pH resulted in poor color and clarity in the plant effluent.

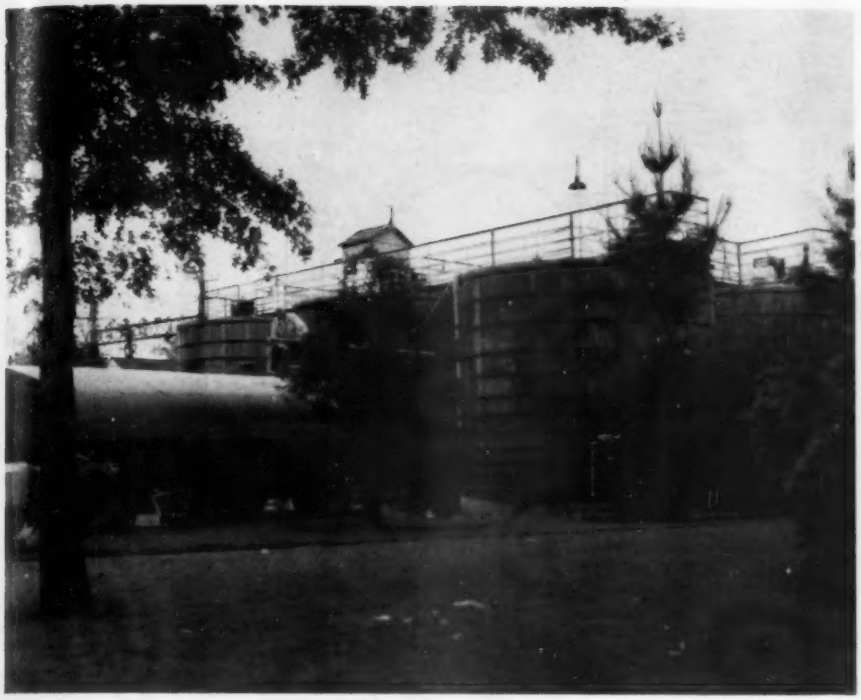
Recent Studies With Sodium Metabisulfite

By 1950 the volume of plating room waste water had increased to 250,000 gallons per day. Water-use surveys in the various departments helped locate excessive use, and the average daily volume was reduced to about 160,000 gallons. It had been necessary to erect six additional 20,000 gallon redwood tanks, making a total of eight reaction tanks. The new units were equipped with stainless steel propeller-type stirrers, extended through the side of the tanks at right angles to the bottom. This gave more complete mixing than did the paddles on the center vertical shafts in the first two units.

The use of sodium metabisulfite, known also as anhydrous sodium bisulfite and as A.B.S., was suggested as a reducing agent in place of the black ash (barium sulfide) which had been returned to after tests with other compounds. In contrast to the black color, difficulty in dissolving and unpleasant odor of barium sulfide, the metabisulfite is a clean, white, easily dissolved, and practically odorless chemical. It is so soluble that it is added directly to the treatment units without need for the dissolving tank or special feeding equipment. The reaction with chromic acid is:

$$3Na_2S_2O_5 + 4CrO_3 + 4H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 2Na_2SO_4 + 2NaHSO_4 + 3H_2O$$

Waste water pumped to the top of retention tanks taking advantage of some aeration.



Pumping sludge into the tank trailer.

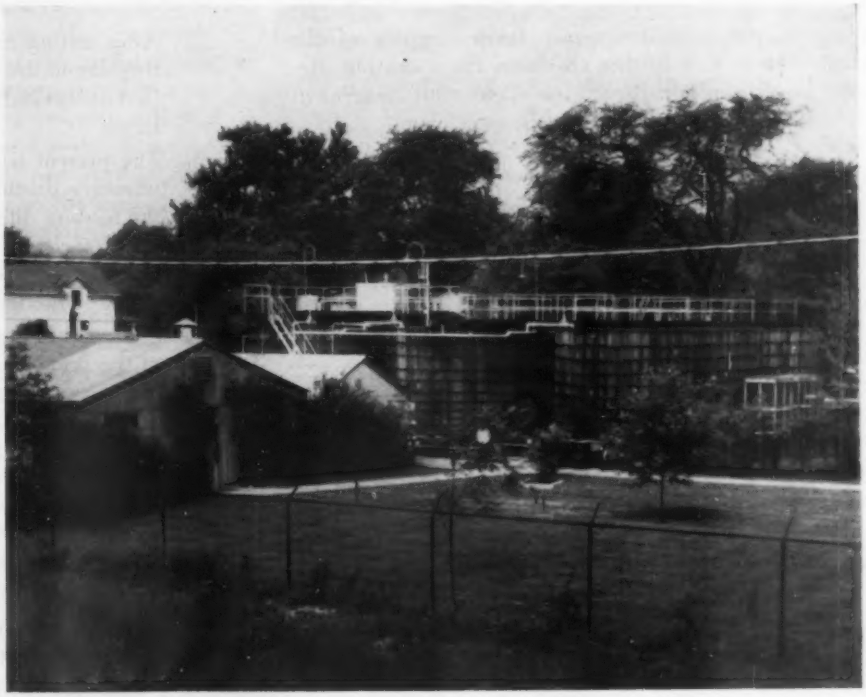
As in the case of the other reducing agents it is desirable to reduce the pH to between 2.0 and 3.0 when A.B.S. is used. Doses in the plant have average about 1.5 pounds of A.B.S. per 1,000 gallons of waste, varying upwards and downwards depending on the chromium concentration. The reduction is rapid and hydrated lime can be added usually within 10 to 15 minutes to raise the pH to 7.0 or above, where the chromic hydroxide and other metallic hydroxides precipitate. After neutralization, the batch is permitted to settle from 0.5 to 1.5 hours. Settling is fast and sludge volumes have been smaller than with other treatments.

Handling of Sludge

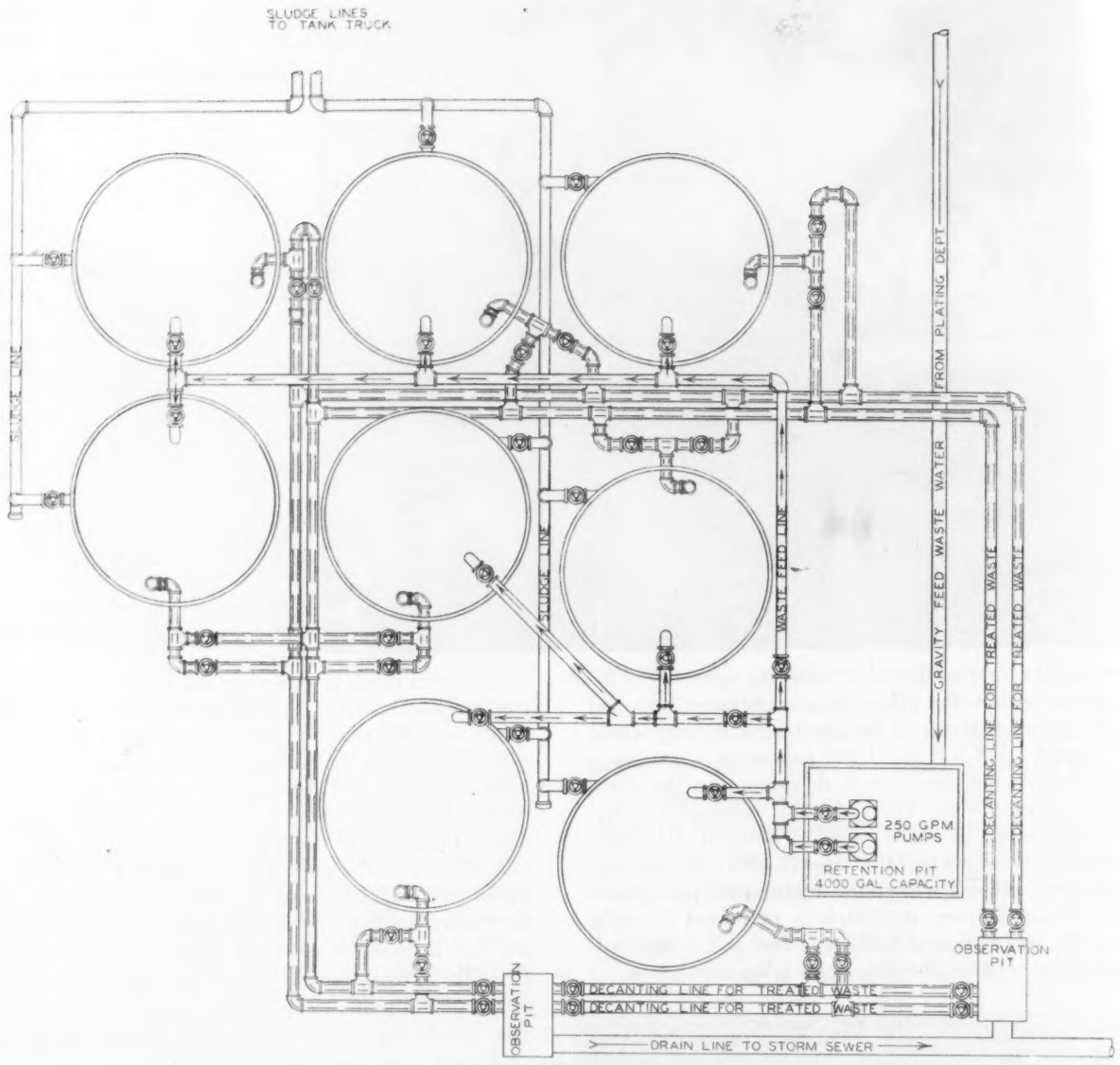
The dewatering of sludge by the filter presses proved to be a slow and costly procedure. It was discontinued in favor of carting the liquid sludge to a municipal disposal area several miles away by means of a 3,000 gallon trailer tank. It has been customary to let the sludge remain in the reaction tanks for several fills. This results in a greater quantity to drawoff, a heavier sludge, and reduces the number of hauls of the tank truck.

Control

The waste plant has simple but adequate laboratory equipment, consisting of a potentiometer for pH determinations, standard sulfuric acid and A.B.S. solutions for determining amounts of these to add, and Nessler tubes with standard colors of low to zero chromium content for comparing with the colors obtained in the waste water before neutralization. Hexavalent chromium solutions have a typical yellow color easily observed down to extremely low chromium concentrations. The operator takes a gallon sample of the waste water from the reaction tank to the control laboratory where he checks the sample for the amount of chromium in the waste. This gives him a rough idea on how much A.B.S. he will have to add. Next, the pH is determined by means of the potentiometer and is adjusted to a pH of 2.0. The estimated amount of A.B.S. is then added and adjusted until the typical yellow color of the chromium fades away to a green-blue. The operator then knows that sufficient A.B.S. has been added. In addition to the small control laboratory, the plant proper has a well equipped laboratory which periodically checks the results of the small lab, and assists in setting-up new procedures. The Connecticut State



View of treatment plant showing storage shed (next to tanks) which houses both lab and chemicals.



Piping layout of Treatment Plant.

Water Commission frequently takes samples of the plant effluent as a further check on the operation. Results have been consistently excellent with hexavalent chromium rarely being present in the effluent.

Typical Chart Showing Chromium Reduction With A.B.S.

Sample No.	Raw Composite pH	Hex. Chromium	Nickel	Treated Composite pH	Hex. Chromium	Nickel
1	3.9	28 PPM	112 PFM	6.5	0 PPM	4.6 PPM
2	5.15	25	84	6.95	0	5.6
3	4.75	19	120	7.98	0	0.7
4	6.5	31	27	8.0	0	10.0
5	6.12	26	23	9.4	0	.0
6	6.38	47	21	8.47	0	2.4
7	5.58	29	18	10.0	0	1.5

Conclusions

1. Batch treatment units provide an ideal type of equipment for experimental work.
2. After testing many chemicals, the most satisfactory found thus far has been treatment with sodium metabisulfite, sulfuric acid and hydrated lime.
3. The present treatment has eliminated an unsatisfactory dusting and odor problem, minimized the feeding difficulties with some chemicals, provided a clean easily stored material, and is one which reacts rapidly and insures complete chromium reduction.
4. Sludge volumes have been less than with some of the previous reducers and this has kept hauling costs to a minimum.
5. Labor is no problem and control by nontechnical operators has been simplified with the A.B.S. treatment.

Acknowledgment

The investigations and helpful suggestions of the Connecticut State Water Commission, the research laboratories at Wesleyan University, and the General Chemical Division of the Allied Chemical & Dye Corporation are gratefully acknowledged.

Sequestering Agents in Aluminum Etching

By Francis J. Prescott, John K. Shaw & Jay Lilker, *Technical Service Dept., Chas. Pfizer & Co., Inc., Brooklyn, N. Y.*

SEQUESTERING agents, especially the polyhydroxy acids, have the ability to minimize a major difficulty encountered with caustic soda baths used for aluminum etching. The prevention of precipitation through the use of polyhydroxy acids has been frequently referred to in the literature, but there is very little information on the practical application of this principle in aluminum etching baths.

Before aluminum can be anodized, plated, or subjected to other finishing techniques, its surface must be thoroughly cleaned. One of the most widely accepted methods for this operation is the etching process, in which the aluminum is dipped in a strong acid or alkali bath. The acid or alkali reacts with the aluminum and removes a fraction of its surface, generating hydrogen and forming an aluminum salt. An alkaline etch solution, being more convenient and easier to control, is usually preferred to a nitric-sulfuric type bath.

The reaction of caustic soda and aluminum leads to the formation of a gelatinous aluminum precipitate and subsequent scale formation on the sides of the etching tank and the submerged steam coils. The scale developes in a short period of time — usually within a week — and prevents effective heat transfer from the steam coils. This condition is usually permitted to exist for six weeks or until the efficiency of the bath is seriously impaired. Then, the scale is removed by laborious and expensive manual methods. The labor and expense of scale removal can be considerably reduced through the use of compounds which form tightly bound water-soluble metal complexes. This complexing (sequestering) action effectively prevents the precipitation of the metal within the complex by such anions as hydroxyl or carbonate.

As early in 1922, Hakomori[1] noted that ammonia failed to precipitate aluminum hydroxide in the presence of tartaric acid. Hakomori did not offer any explanation as to why the usual precipitate did not form, but it is now well known that polyhydroxy acids such as tartaric, form soluble metal complexes and prevent the precipitation of metallic hydroxides.

Mellor's[2] treatise substantiates the fact that aluminum hydroxide is soluble in tartaric, malic, citric and many other organic acids and that the presence of these compounds prevents the precipitation of aluminum hydroxide in alkaline media.

When Fink and Summers[3] prepared aluminum gluconate by an electrolytic process, they noted that it went into solution readily, and that the addition of strong caustic or ammonia did not precipitate aluminum hydroxide. It has also been observed that solutions of aluminum salts when allowed to react with gluconic acid or with salts of gluconic acid were not precipitated in the presence of alkaline earth metal hydroxides[4,5] or ammonium hydroxide.[6]

Similar results were apparent when Pariselle[7] worked with aluminum-tartrate complexes in caustic solutions.

Many applications have been found for polyhydroxy acids as sequesterants for the heavy metals. Gluconic acid is mentioned as being useful in processes where the prevention of precipitation of iron, aluminum, etc.

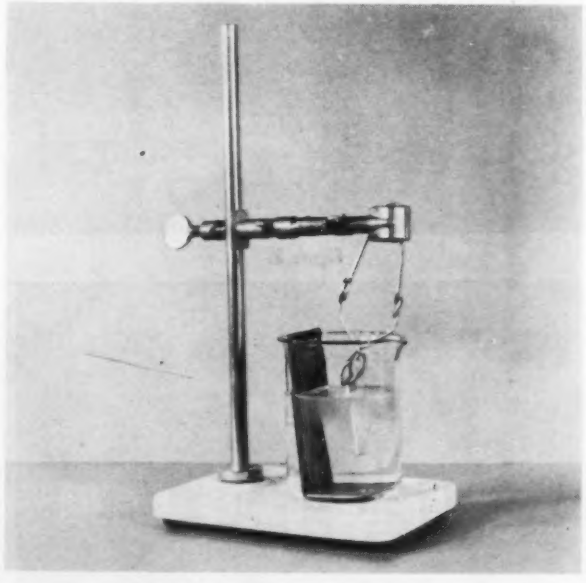


Figure 1. Test equipment. Steam bath heating equipment not shown.

by alkali is desirable.[8] For example. it has been used in the aluminum tanning of leather. Aluminum which precipitates as the hydroxide at the pH of an aluminum tanning bath is kept in solution by gluconic acid.[9]

The sodium salt of gluconic acid has been useful as a sequesterant in the alkaline cleaning of ferrous metals. The presence of gluconate prevents the undesirable precipitation of iron hydroxides.[10]

The complexing ability of tartrate salts has been employed to advantage for many years in electroplating processes. Citric acid has been found valuable as a heavy metal sequesterant in both algaecidal preparations[11] and wine clarification compounds.[12]

Laboratory tests were made to examine the effect of several sequesterants in aluminum etching baths. Other additives were included in the test either because of a theoretical possibility for their use, or because mention of their use in similar processes has been made in the literature. The efficiency of the additives was judged by observing the ease of rinsability of the scale formed.

Experimental

An effort was made to stimulate as closely as possible actual practice in aluminum etching. A steel plate was partially immersed in the caustic solution so that a metal surface would be available for the deposition of scale (see figure 1). Temperature and caustic concentration were those generally employed in commercial aluminum etching.

The conditions for the test were as follows:

1. Concentration of caustic ..... 4 ozs. per gallon
1. Concentration of additives .... 1, 2.5, 5% (based on dry sodium hydroxide)
3. Temperature ..... 70°C. for 1 hour, room temperature overnight.

In each run, equal amounts of type 2S aluminum were permitted to dissolve in the caustic solutions over the one hour heating period. At the conclusion of the overnight standing period, the supernatant liquid was decanted and the scale formation on the steel plate and on the surface of the beaker was tested for ease of rinsability. These findings are summarized in Table I.

Table I

Additive	*Beaker Appearance*		*Plate Appearance*	
	Clean	*Scaled*	*Clean*	*Scaled*
Control		x		x
1.0% Sodium Gluconate	x		x	
2.5% Sodium Gluconate	x		x	
5.0% Sodium Gluconate	x		x	
1.0% Sodium Citrate		x		x
2.5% Sodium Citrate		x		x
5.0% Sodium Citrate		x		x
1.0% Tartaric Acid	x		x	
2.5% Tartaric Acid	x		x	
5.0% Tartaric Acid	x		x	
1.0% Glucoheptonic Lactone	x		x	
2.5% Glucoheptonic Lactone	x		x	
5.0% Glucoheptonic Lactone	x		x	
5.0% Oxalic Acid		x		
1.0% Alkyl-Aryl Sulfonate		x		x
2.5% Alkyl-Aryl Sulfonate	x		x	
5.0% Alkyl-Aryl Sulfonate	x		x	
5.0% Hydroxyacetic Acid (Glycollic)		x		x
5.0% Sodium Tetraphosphate		x		x
5.0% Sucrose		x		x
5.0% Sorbose		x		x
5.0% Ethylene Diamine Tetraacetic Acid		x		x

Figure 2.

Figure 3.

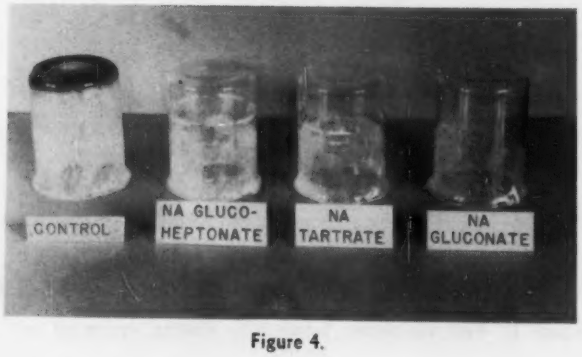


Figure 4.

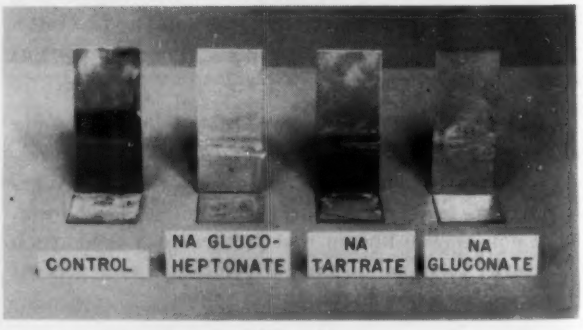


Figure 5.

Figure 6.

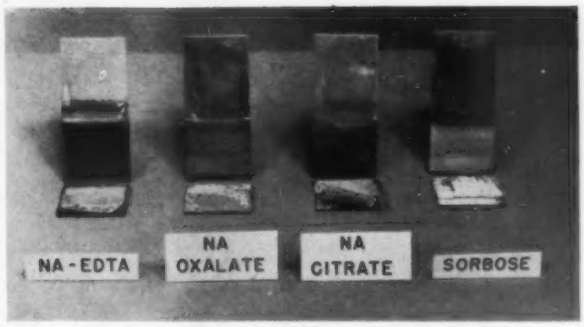


Figure 7.

Figure 8.

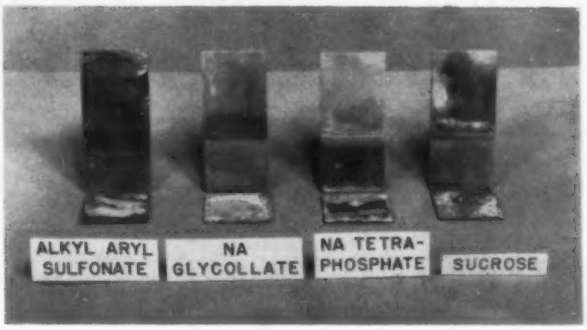


Figure 9.

Figures 2 and 3 depict the appearance of two typical beakers and plates before and after all rinsable scale has been removed by hot water flushing.

Figures 4 through 9 show more clearly the appearance of the beakers and plates after the test using 5% additive to the caustic solution.

Sodium gluconate, glucoheptonic lactone, alkyl-aryl sulfonate, and tartaric acid were the four additives of those tested which successfully prevented adherent scale formation. The alkyl-aryl sulfonate at a level of 1% however was ineffective and had the further disadvantage of creating uncontrollable foaming when the solution was heated. This latter condition was more in evidence at the higher levels of 2.5 and 5% where the alkyl aryl sulfonate permitted free rinsability.

Conclusions

Scale produced in baths containing the polyhydroxy acids was effectively removed by simple rinsing. Gluconic acid was found to be the most efficient additive for both preventing the formation of adherent non-rinsable scale, and actually reducing the amount of scale formed. Tartaric and glucoheptonic acids were next in effectiveness. The alkyl aryl sulfonate at higher levels was satisfactory but had the disadvantage of foaming.

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Electroplating on Beryllium

By John G. Beach and Charles L. Faust, *Battelle Memorial Institute, Columbus, Ohio*

Introduction

BERYLLIUM is a light, hard, brittle metal. It is lighter than aluminum and heavier than magnesium. Metallurgical and mechanical fabrication of beryllium are complicated by its brittleness, and, as one machinist emphasized: "Treat the stuff as glass." Chemically and electrochemically, beryllium is similar to aluminum, zinc, and magnesium. Therefore, methods for plating on these metals[1] were considered.

Reduction of metal iodides and carbonyls on beryllium surfaces had been explored, but not pursued, because of the greater ease of electroplating metals. The work of Kolodney (reported at a later date[2]) describes a method for electroplating on beryllium. Comparison of the above process with the one reported herein for direct plating on beryllium was made. Although both processes are satisfactory for thin electrodeposits (<1 mil), heavy electrodeposits such as silver (>2 mils) on beryllium using Kolodney's process could be peeled, whereas comparable electrodeposits using the process reported herein could not be peeled.

Methods for Plating on Beryllium

General Comments

Some plating baths will attack beryllium and prevent satisfactory electrodeposition of another metal. For example, high acid baths containing sulfate, chloride, fluoborate, or fluoride chemically attack on active beryllium surface. Chromic acid solutions passivate beryllium surfaces and prevent the direct deposition of adherent chromium.

The flowsheet in Figure 1 shows the over-all operations used to electroplate on beryllium. Eight variations in the preliminary preparation were used without noticeable effect on the adhesion. The recommended procedure contains several precautionary operations that have not been fully evaluated.

The plating methods were used for the preparation of beryllium samples for testing and were proven adequate. Study of varying the operations has been limited.

Preliminary Surface Preparation

Descaling.—Heat-treating, extrusion, and rolling scales (oxides and/or nitrides) generally are not removed uniformly chemically. Since machining operations probably would precede any electroplating operation, scale removal was not considered a problem.

Cleaning.—Greases and oils are best removed by organic-solvent degreasing (vapor or contact). Residual dirt is removed by cathodic cleaning in a caustic solution (e.g., 25 to 75 amp./ft.^{2} in 50 to 100 g./l. NaOH or KOH at room temperature). Although solvent degreasing is generally sufficient, alkaline cleaning would be recommended when a number of parts are to be processed.

Chemical polishing.—Chemical polishing to remove the as-machined beryllium surface was studied to provide uniformly sound metal for electrocladding. The following solution and conditions were used: 5% H_2SO_4, 75% H_3PO_4, 7% CrO_3, balance water; 120°F. (49°C.), 1 mil. removed in 20 minutes.

Since chemical polishing preferentially dissolves

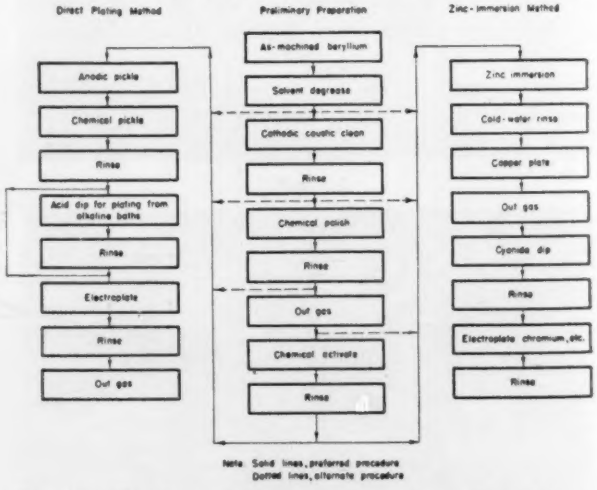

Figure 1. Flowsheet of the operations used to electroplate on beryllium.

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impurities and opens subsurface porosity, its use was limited to that of an inspection tool for machine damage.

To determine if chemical polishing was causing or propagating cracks, a 1-in. diameter, as-extruded, beryllium rod (apparently free of cracks) was alternately cylindrically ground and chemically polished successively with the following observation: (*a*) As extruded, crack free; (*b*) Chemical polish, crack free; (*c*) Grind to true bar, no cracks apparent; (*d*) Chemical polish, circumferential cracks over length; (*e*) Grind (—20 mils), no cracks apparent; (*f*) Chemical polish, fewer cracks; (*g*) Grind (—20 mils), no apparent cracks; (*h*) Chemical polish, remaining cracks concentrated at center ends of bar. These results preclude cracking by chemical polishing, and apparently cracks, once formed, can be removed by further machining. Cracking was attributed to a flexing stress during the first, cylindrical-grinding operation.

Activating pickle.—Chemical polishing leaves a semipassive surface film, presumed to be beryllium oxide or chromate. Although this film is generally dissolved during subsequent operations, its removal in room-temperature sulfuric acid solutions is preferred so as to more uniformly activate beryllium surface. Pickling for ¼ to ½ minute in 10 per cent (by volume) of concentrated sulfuric acid at 80 ± 10°F. (25°C.) has been satisfactory.

Direct Plating Method

The following steps are used for adherent electroplating directly onto beryllium surfaces (approximately 0.5 mil of the beryllium surface is dissolved).

(*a*) *Anodic pickle:* 10 volume per cent of 85% H_3PO_4; 2 volume per cent of 38% HCl; balance—water; 80 ± 10°F. (25°C.); 100 ± 50 amp./ft.^{2}; 2 minutes.

(*b*) *Chemical pickle:* concentrated nitric acid (70% HNO_3); 80 ± 10°F. (25°C.); 2 minutes.

(*c*) *Water rinse.*

(*d*) *Acid dip:* (for plating from alkaline baths) 100 g./l. ammonium sulfate $(NH_4)_2SO_4$; pH 2 with H_2SO_4; balance—water; 80 ± 10°F. (25°C.); ½ to 1 minute.

(*e*) *Water rinse.*

(*f*) *Electroplate:* aluminum, copper (baths I or II), nickel (baths I plus II), iron, and zinc (bath I) can be adherently electrodeposited after step (*c*). Presumably, the sulfate, citrate, or tartrate inhibits the precipitation of beryllium hydroxide at the interface.

To electroplate metals such as silver or tin from highly alkaline solution, steps (*d*) and (*e*) are included. Again the sulfate inhibits the formation of beryllium hydroxide at the interface.

An advantage of this method is direct application of most of the electrodepositable metals. A disadvantage is the preferential dissolution of inclusions (such as extrusion stringers, etc.) during anodic pickling, resulting in voids which are difficult or impossible to bridge.

Zinc-Immersion Methods

This method is similar to those used to electroplate on aluminum and magnesium and depends on the application of an adherent, immersion-zinc film onto the beryllium surface. Since the zinc film is chemically active, the initial electroplate must be from a bath usable for plating on zinc. The following steps were used to electroplate copper plus chromium on beryllium:

(*a*) *Zinc immersion:* 120 g./l.—$Na_4P_2O_7$; 40 g./l.—$ZnSO_4 \cdot 7H_2O$; 7.5 g./l.—NaF; 5 g./l.—K_2CO_3; pH 7.5 to 8.0—H_2SO_4 and H_3PO_4; 180+°F. (82+°C.) 5 minutes' immersion.

(*b*) *Cold water rinse.*

(*c*) *Copper plate* (bath III).

(*d*) *Water rinse.*

(*e*) *Outgas:* heat for 30+ minutes in boiling water.

(*f*) *Cyanide dip:* 45 g./l.—NaCN; 80 ± 10°F. (25°C.)—½ to 1 minute.

(*g*) *Water rinse.*

(*h*) *Acid dip:* dip in 3N sulfuric acid at room temperature (80 ± 10°F.) (25°C.).

(*i*) *Water rinse.*

(*j*) *Chromium plate.*

The copper plate (step *c*) is to protect the zinc film during subsequent chromium plating. Nickel (bath I), iron, and zinc can also be plated directly over the zinc film.

Outgassing (step *e*) prevents blistering of the copper.

An advantage of this method is the formation of a more uniform surface for plating. A disadvantage might be the required zinc film.

Plating Baths

Aluminum.—Aluminum can be plated directly on pretreated beryllium from a nonaqueous (organic) electrolyte composed of ethyl pyridinium bromide-aluminum chloride eutectic.[3] After anodic and chemical activation, the beryllium was rinsed and dried with alcohol, then immersed in benzene before plating. The aluminum (1 mil) could not be peeled or cut off at the aluminum-beryllium interface.

Chromium.—Chromic acid solutions passivate beryllium surfaces. Therefore, chromium is plated over another intermediate metal on beryllium. In this work, copper over immersion-zinc film was used as a basis for chromium plating. Chromium was plated from a standard chromic acid bath (400 g./l. CrO_3, 4 g./l. H_2SO_4, balance—water) using 110 amp./ft.^{2} at 113° F. (45°C. or 220 amp./ft.^{2} at 130°F. (54°C.).

Copper.—Copper can be plated directly on beryllium (baths I and II) and on the immersion-zinc film (bath III). Acid, copper sulfate, plating baths chemically attack beryllium and zinc, preventing satisfactory deposition, unless preceded by a strike plate.

I. Copper pyrophosphate bath: "Unichrome" process, United Chromium Corporation; pH 8.5; 140°F. (60°C.); 40 amp./ft.^{2}

II. Cyanide bath: 30 g./l. NaCN; 22.5 g./l. CuCN; 15 g./l. $NaCO_3$; 0.5 g./l. $Na_2S_2O_3$; pH 9 with tartaric acid; 120°F. (49°C.); 25 amp./ft.^{2}

III. Cyanide bath: 46 g./l. NaCN; 26 g./l. CuCN; 15 g./l. K_2CO_3; 7.5 g./l. KOH; 22.5 g./l. NaF; pH

3. Proprietary addition agent, Harshaw Chemical Company.

13.2 ± 0.1; 130°F. (54°C.); 30 amp./ft.² 1 minute; 15 amp./ft.² thereafter.

Iron.—Attempts to plate iron directly on beryllium using iron-plating methods reported in the literature were unsuccessful. The baths attacked the berylium and/or produced pitted deposits.

Iron was plated directly on beryllium using a modified bath: 300 g./l. $FeSO_4 \cdot 7H_2O$; 42 g./l. $FeCl_2 \cdot 4H_2O$; 35 g./l. H_3BO_3; 15 g./l. NaCOOH; 15 g./l. $(NH_4)_2SO_4$; 1 g./l. Duponol ME; pH 4.0; 140°F. (60°C.); 40 amp./ft.²

The bath is also suitable for plating over zinc.

Nickel.—Nickel can be plated on beryllium directly and after immersion-zinc coating. A strike nickel plate (bath I) is required to protect the beryllium and/or the zinc from chemical attack.

I. Strike nickel bath: 143 g./l. $NiSO_4 \cdot 7H_2O$; 75 g./l. $MgSO_4 \cdot 7H_2O$; 15 g./l. NH_4Cl; 15 g./l. H_3BO_3; 20 ml./l. XXXD[3]; pH 5.5 ± 0.1; 90°F. (32°C.); 15 amp./ft.²

The thickness of the strike nickel plate required to protect the beryllium and/or the zinc will vary with the characteristics of the beryllium surface. In this work, 0.3 to 0.4 mil. (30 minutes at 15 amp./ft.²) was used on beryllium. Thicker deposits were built up in the following bath:

II. Nickel-plating bath: 300 g./l. $NiSO_4 \cdot 7H_2O$; 50 g./l. $NiCl_2 \cdot 6H_2O$; 35 g./l. H_3BO_3; 15 g./l. NaCOOH; 20 ml./l. XXXD[3]; pH 4.0; 140°F. (60°C.); 40 amp./ft.²; 1 mil. per 30 minutes.

Silver.—Silver can be plated directly on beryllium using a strike bath as for plating silver on copper.

I. Silver-strike bath: 3.5 g./l. AgCN; 70.0 g./l. NaCN; 80 ± 10°F. (25°C.); 7.5 amp./ft.²; 5 minutes.

Thicker silver deposits are built up in a silverplating bath.

II. Silver-plating bath: 75 g./l. AgCN; 112 g./l. KCN; 22.5 g./l. K_2CO_3; pH 13.0 with KOH; 120°F. (49°C.); 25 amp./ft.²; 1 mil. per 15 minutes.

Tin.—Tin can be plated directly on beryllium: 150 g./l. $Na_2SnO_3 \cdot 3H_2O$; 15 g./l. NaOH; 22.5 g./l. $NaC_2H_3O_2$; 150°F. (66°C.); 25 amp./ft.²

Zinc.—Zinc can be plated on beryllium directly or after immersion-zinc coating: 240 g./l. $ZnSO_4 \cdot 7H_2O$; 15 g./l. NH_4Cl; 30 g./l. $(Al_2(SO_4)_3 \cdot H_2O$; 70 g./l. $MgSO_4 \cdot 7H_2O$; 1 g./l. licorice; pH 4.0; 80±°F. (25° C.); 25 amp./ft.²

Alkaline zinc baths could also be used with the advantage of better covering power.

Other metals.—Other electroplated metals can be applied directly on beryllium or over another metal that can be electrodeposited directly. Direct plating requires a bath that does not chemically attack beryllium. Modification of certain baths might be necessary.

Outgassing

Hydrogen absorbed during pickling, chemical polishing, and/or plating, if not removed, can destroy a good as-plated bond. Atomic hydrogen enters the beryllium and can be outgassed through thin electrodeposited metals. If the atomic hydrogen combines to form molecular hydrogen under the electroplate, it is trapped and exerts high stress at the interface.

Periodic outgassing eliminated blistering in this work. The method of outgassing depended on the amount of hydrogen entering, the permeability of the electrocladding to hydrogen, and the subsequent operations.

Heat treating at 932°F. (500°C.) was used to outgas iron-plated beryllium prior to nickel plating. Outgassing occurred at room temperature in three to five weeks. When outgassing of the iron was omitted, the composite iron-nickel electroplate blistered at the iron-beryllium interface.

Chemically polished beryllium was outgassed by heating in boiling water for 30 minutes. After zinc-immersion coating and copper plating, the beryllium was again outgassed similarly. Omitting either outgassing step generally resulted in blistering of the copper plate within twenty-four hours.

Diffusion and Alloying

Diffusion at elevated temperatures complicated the protection of beryllium by electrodeposited metals. If little or no diffusion occurred, use at elevated temperatures would be mainly a problem of corrosion protection. However, when diffusion occurs, it introduces a continually changing electroplate-beryllium interface.

Solid-solution alloying could probably maintain a satisfactory bond between the electrocladding and the beryllium, but the rate of diffusion would tend to dictate the usability of such an electrocladding. If intermetallic compounds (generally weak and brittle) were formed, a good as-plated bond would probably be destroyed. When compounds are formed, apparently the crystal lattice is expanded, accompanied by a volume change, forcing a separation of the electrocladding on beryllium.

Nickel and beryllium start to diffuse at a temperature between 662°F. (350°C.) and 752°F. (400°C.) in 18 hours. After 666 hours at 600°F. (316°C.), no alloying was apparent.

Iron and beryllium start to diffuse at a temperature between 932°F. (500°C.) and 1022°F. (550°C.) in 18 hours. After 720 hours at 932°F. (500°C.), slight alloying was apparent.

These observations suggest that electrodeposited nickel on beryllium should be considered for extended use only at temperatures below 662°F. (350°C.). Similarly, iron on beryllium should be considered for extended use only at temperatures below 932°F. (500° C.). Chromium over electrodeposited copper on immersion-zinc-coated beryllium retained a good bond at elevated temperatures. The immersion zinc and thin copper (0.2 mil.) formed a solid-solution alloy with the beryllium. Diffusion of the chromium plate with a copper-zinc-beryllium, diffusion-alloy surface was not observed. Heavy copper plate formed a brittle alloy with the zinc and beryllium, resulting in spalling of the chromium plate at elevated temperatures.

Adhesion Testing and Inspection Methods

Adhesion tests are generally qualitative and destructive. However, the adhesion of electroplated metals on beryllium was estimated using the following tests:

(*a*) Filing or grinding an edge of the plated sample so that the stress is across the electroplate-beryllium interface. This stress will be influenced by the strength and thickness of the electrodeposited metal.

(*Concluded on page* 73)

The barrel finishing department is right in the machine shop area.

Washing Dollars out of Deburring

By Gordon B. Ashmead

ONE of the most time-consuming sequences in any assembly flow has always been the hand-finishing of critical parts. Particularly is this true of the numerous parts for jet engine components or for piston engine exhaust systems. *Ryan Aeronautical Company* of San Diego knows these problems for they make "hot-end parts" for both types of power.

Ryan has used a variety of finishing methods — polishing and buffing wheels, grinders, files, scrapers. These have long been the accepted tools for smoothing off the edges left by forming and rough machining. While other stages of production routine were gradually mechanized in efforts for peak efficiency and volume, deburring remained a step-child that continually sulked itself into a bottleneck.

Conditions have now changed. The photos show views the department that, set down right in the machine shop area, has eliminated any possibility of bottleneck and offers a fine opportunity of saving as much as $100,000.00 a year on deburring operations alone.

The installation has the appearance of a self-service laundry. Octagonal cylinders revolve. There is the gentle thump as parts and abrasives drop on the baffles of the cylinders. Steam arises from the water and detergent compounds that are added to the cylinders at more or less regular intervals. Water slushes into the drain as cylinders are emptied. In a sense, this portion of the plant is a laundry — a metal laundry in which rough, stained metal parts are given smooth edges and a bright glaze.

This is one of the most elaborate operations of its kind on the West Coast, a battery of four giant deburring machines that have already processed millions of parts for jet and piston aircraft engines. An analysis of their first two months' activity has been completed by *James N. Willits*, Ryan methods engineer who supervised the machines' installation and the training of the operators. This survey has led to an estimate that as much as $100,000.00 a year may be saved on deburring operations alone, based on the present work load.

The machines, however, have various other applications. Surface corrosion, fused weld flux and heat-treat scale are being removed, obviating the more cumbersome and slower sandblasting method.

In mechanical tumbling, hundreds of parts are simultaneously smoothed and polished in a gently abrasive action of grinding chips (stones) and detergent compounds. As the parts are mixed with the chips and the chemical compounds in the rotating cylinder, the burrs, tool marks and other projecting edges are worn away. For each type of metal a different time cycle is used ranging from minutes to hours. The mild grinding goes on automatically and constantly, with one or two operators able to handle several machines.

Larger parts which would be damaged if "free-

tumbled," are clamped in fixtures, several at a time, and held stationary in a machine adapted to their use. The chips then tumble against the parts that are held in a fixed position as the machine rotates.

The grinding chips are of three types — aluminum oxide, granite and limestone — and come in different sizes. The type of stone and its size are dictated by the job to be performed. Large chips cut faster, but small chips result in a smoother finish and are able to grind areas not accessible to the larger stones.

At Ryan, the chips are stored in eight large bins from which they are dumped into hoist pans on casters. A crane lifts the hoist pan and inserts its nose into an opening in the tumbling machine. The chips roll in. Then a detergent compound in water is poured into the cylinder. During the tumbling action the burrs are likely to rub off onto the abrasive chips which in turn may reapply this loose metal back to the parts, resulting in a dull, lusterless finish. The detergents, by lowering the surface tension of the water, enable the liquid to wet parts better, get "under" the dirt and grime, and then keep the metal waste in suspension.

Like the variety of chips, different kinds of detergents are prescribed, depending upon the types of metal in the parts. The detergents range from mild, surface-conditioning powders to strong acid compounds for removal of heat treat scale. Many of the detergents are obtained from the tumbling machine manufacturer, but Ryan has developed its own compound for removal of fused weld flux and for particularly bright finishes on stainless steel parts.

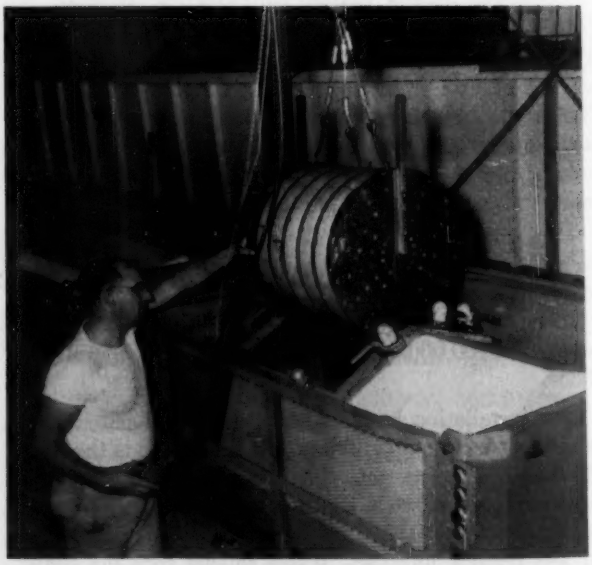
Created in the Ryan laboratories, the compound is a formulation of acids and wetting agents, originally developed for use in the final cleanup of large stainless steel assemblies where discolorations, shop blemishes, etc., are removed. It was found admirably suited as a detergent compound in the "Machine Shop Laundry."

At given rotation times, an automatic timer stops the machine, and the parts and chips are unloaded into the hoist pan. A variable speed control governs the rota-

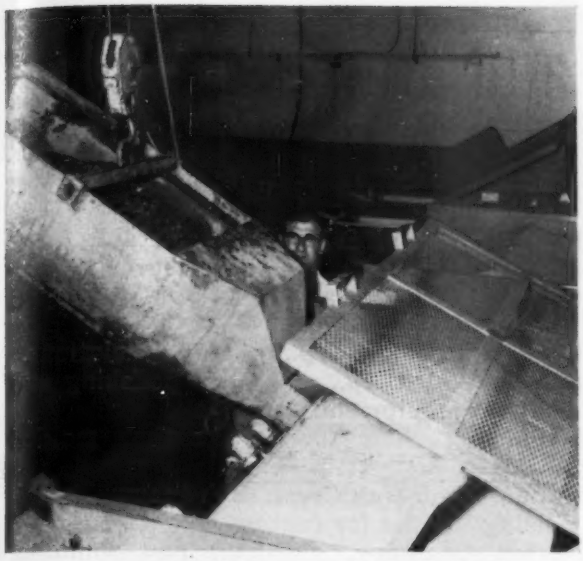
Parts to be finished are placed in the cylinder.

Detergent is allowed to escape from the cylinder after deburring a large number of parts.

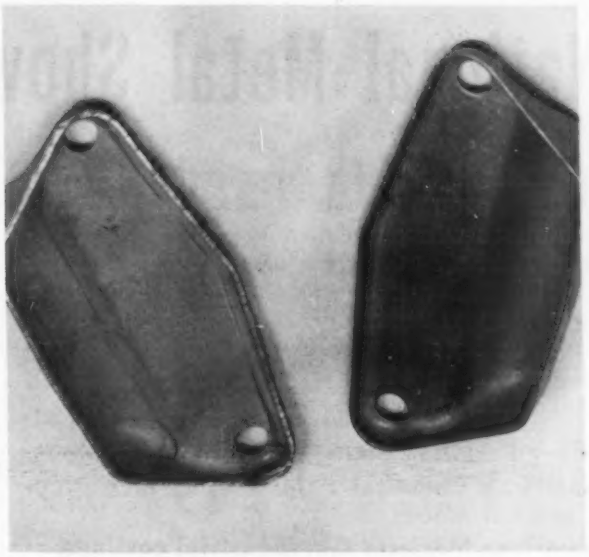
After parts and grinding chips are removed from the machines they are separated in this mechanical separator.



Large parts that should not be tumbled are placed in the fixture and lowered into the machine.

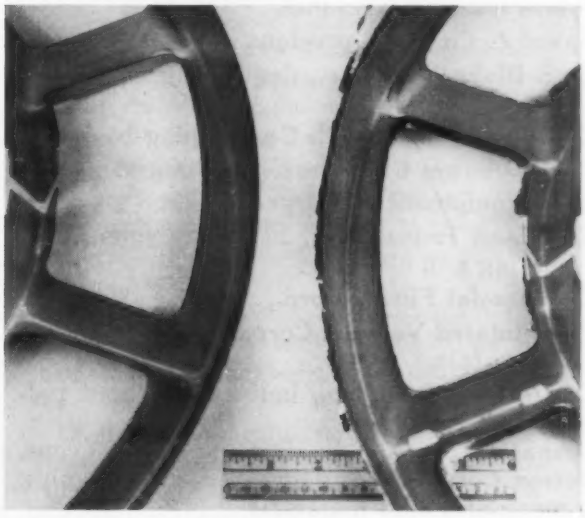


An overhead crane lifts a hoist pan containing chips for placement in the cylinder.



Before and after shots of a stainless part for a jet engine.

Before and after shots of a carburetor heat takeoff tube for Continental Tank engine used in the General Patten M-48.



Before and after shots of a Westinghouse jet afterburner part. Note the clean lines and smooth edges of the finished part on the left.

tion which is usually slower with the heavier parts to prevent damage in the tumbling action.

After unloading, the parts are separated from the chips in a mechanical separator and the chips are screened for size. The chips may be used again and again until they are too small for practical application.

Whether the objective is grinding, deburring, descaling, polishing or high, mirror-like coloring, the metal laundry in the machine shop at Ryan is getting the job done on a mass production basis.

ELECTROPLATING ON BERYLLIUM

(*Concluded from page* 70)

(*b*) Fracturing the electroplated beryllium sample.

(*c*) Chiseling or prying with a knife at the electroplate-beryllium interface.

(*d*) Heat and quench.

Nondestructive test methods for adhesion and other defects in electroclad samples were considered:

(*a*) Chemical polishing was used to reveal machining damage in the beryllium, presumably by removing a worked skin.

(*b*) "Zyglo" and "Dycheck" examinations were used to reveal pits and cracks by use of a fluorescent oil or dye penetrant. These inspection methods are said to reveal defects, open to the surface, of less than 0.000005 in. However, subsurface defects are masked.

(*c*) Magnetic-induction (Du Mont Cyclograph) testing, Magnaglo (magnetic-particle inspection), Reflectoscope, and Reflectogage (ultrasonic test methods) were considered. Evaluation beyond the scope of this investigation would be needed to apply these methods to electroclad metals on beryllium.

References

1. "Electroplating on Aluminum and Its Alloys," Aluminum Company of America, 1946. H. K. DeLong (Dow Chemical Company), "Electroplating on Magnesium and Its Alloys." U. S. Pat. 2,512,503 and Bulletin DM108.
2. M. Kolodney, "Electroplating on Beryllium," AECD 2845, August 25, 1950.
3. W. H. Safranek, W. C. Schickner, and C. L. Faust, J. Electrochem. Soc., **99**, 53 (1952).

National Metal Show and Congress

THE largest show in the thirty-five years of these events with more than four hundred exhibitors will open at the renovated Cleveland Public Auditorium at noon on Monday, October 19th and extend through the week. A very large attendance is expected as indicated by hotel reservations. A number of exhibits will be of interest to metal finishing executives, which we are listing as follows:

Alvey Ferguson Co., degreasers and washers.
American Chemical Paint Co., surface preparation materials.
American Marietta Co., industrial coatings.
American Wheelabrator & Equip. Co., abrasive blasting machines.
Baker & Co., Inc., precious metal solutions.
G. S. Blakeslee & Co., degreasing and washing equipment.
Cambridge Wire Cloth Co., dipping baskets.
Carborundum Co., abrasive belts and grains.
Circo Equipment Co., degreasers and washers.
Cleveland Process Co., heating elements for plating and cleaning.
Commercial Filters Corp., filters.
Consolidated Vacuum Corp., process for coating metals.
Curtis Machine Corp., belt sanders and polishers.
Despatch Oven Co., baking and drying ovens.
Detrex Corporation, degreasers and cleaning machinery and materials.
The Diversey Corp., cleaners and surface preparation materials.
E. I. duPont de Nemours & Co., processes and materials for finishing.
Eclipse Fuel Engineering Co., gas burners.
Enthone, Inc., blackening salts, cleaners and metal finishing chemicals.
Goodison Mfg. Co., polishing and buffing compounds.
Gray Company, lacquer dispensing pumps.
Hammond Machinery Builders, Inc., automatic polishing and buffing machines.
Handy & Harman, silver and precious metal anodes.
Harshaw Chemical Co., chemicals for plating.
Heil Process Equipment Co., lead and plastic corrosion resistant equipment.
E. F. Houghton & Co., metal cleaners and blackening processes.
R. O. Hull & Co., brighteners, addition agents for plating and testing sets.
Globe Stamping Division, Hupp Motor Car Corp., tumbling and burnishing equipment.
International Nickel Co., nickel and monel metal fabrications.
Jensen Specialties, Inc., infra-red heating equipment.
Kalamazoo Tank & Silo Co., wood tanks.
Manufacturers Processing Co., degreasers.
Merrill Brothers, carboy rockers and liquid handling equipment.
Metal & Thermit Corp., tin plating solutions.
Murray-Way Corp., automatic polishing and buffing equipment.
National Carbon Company, carbon molded heat exchangers.
National Research Corp., high vacuum metallizing process for coating metals.
Norton Company, polishing and tumbling abrasives.
Oakite Products, metal cleaning materials and surface treatment processes.
Osborn Mfg. Co., tampico and wire wheels and brushes.
Pangborn Corp., abrasive blasting machines.
Park Chemical Co., polishing cement.
Parker Rust Proof Co., rust proofing processes and cleaning materials.
Pennsylvania Salt Mfg. Co., cleaning and surface preparation materials.
Phillips Mfg. Co., degreasers.
Porter-McLeod Machine Tool Co., glazing machine for polishing.
Production Machine Co., abrasive belt polishing machines.
Ransburg Electro-Coating Corp., electrostatic painting equipment.
Manhattan Rubber Div., Raybestos-Manhattan Corp., tank linings.
Scientific Electric, electrostatic painting equipment.
Solventol Chem. Products, Inc., cleaners.
Sparkler Mfg. Co., filters.
Standard Electrical Tool Co., polishing lathes.
Frederic B. Stevens, Inc., electroplating equipment and supplies.
Torit Mfg. Co., polishing room dust hoods.
Tranter Mfg. Co., heating elements for plating and cleaning tanks.
The Udylite Corp., plating and anodizing equipment and supplies.
United Chromium Corp., plating and metal coating processes and chemicals.
Ward Leonard Electric Co., small chromium plating unit for hard chromium plating.
Westinghouse Electric Corp., periodic reverse plating controls.

Admission is through membership affiliation by the sponsoring societies or by invitation of an exhibitor who can furnish you with a pass. For detailed information write the American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio.

104th Meeting of The Electrochemical Society

Frank L. Laque, General Chairman of the meeting.

MORE than 250 executives and scientists, representing 144 industrial organizations and 20 colleges, were in attendance at the 104th meeting of *The Electrochemical Society*, held at the International Nickel Company's Kure Beach Corrosion Testing Station, Wrightsville. North Carolina, September 13-16.

During the course of the meeting, the corrosion division of the Society held two special symposia—one on Marine corrosion and the other on titanium corrosion. The electrodeposition division dealt with general electrodeposition problems, while the battery and electrothermic division held round table discussions on various current problems.

The September 15th meeting was highlighted by the second Palladium Medal lecture, delivered by Dr. Nathaniel Howell Furman, chairman of the Department of Chemistry, Princeton University. His subject was — "Coulometry — Related Phenomena of Electrolysis and Current-Sweep Polarography." The Palladium Medal, awarded in recognition of original and outstanding contributions in the fields of corrosion and fundamental electrochemistry, was presented to Dr. Furman at a special banquet on Sept. 15th at the Ocean Terrace Hotel, Wrightsville Beach, N. C. Robert J. McKay, president of the Society, presented the medal.

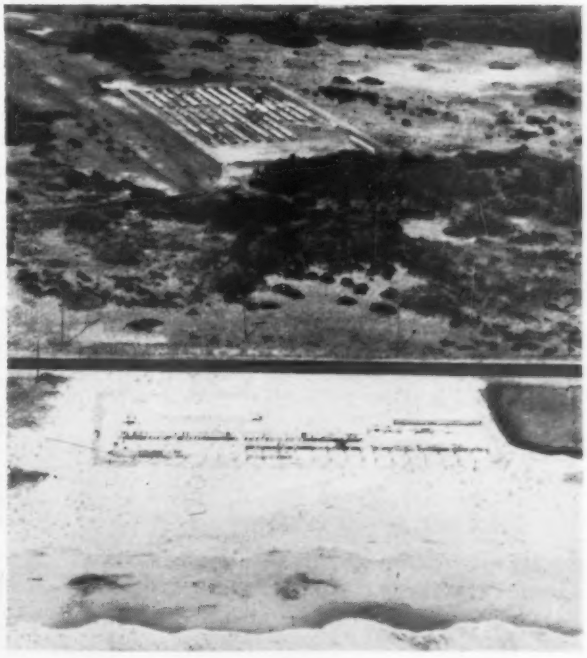
Also at the banquet, president McKay announced the winners of the society's prize essay contest for 1953. Winning cash awards were — Alvin P. Ginsberg, Brooklyn, N. Y., Ahmad Geneidy, Morgantown, West Virginia and Robert S. Johnson, of Oak Park, Illinois. Because of the excellence of the papers, Mr McKay stated, eleven honorable mentions were also awarded. The subject of the essay contest was "Contributions of Electrochemistry to Science."

On September 16th, the General Society luncheon was held at the Ocean Terrace Hotel. Officers of the Society, headed by its senior vice-president, M. J. Udy, expressed their appreciation to Frank L. Laque, general chairman of the meeting, and to the host company for providing the many facilities.

Specially conducted tours to Inco's Harbor Island Laboratory and Kure Beach Sea Spray lot were provided for members. In addition to the 250 Society members, at least 200 guests were also at Wrightsville Beach.

Following the electrochemical meeting, many of its members stayed over until September 18th attending the Seahorse Institute meeting, as well as the Marine Borer meeting.

On the local committee for the meeting were W. G. Dawson, chairman of registration and local transportation; Fred A. Lowenheim, finance; Rod B. Teel,



Air view of sea spray and atmospheric testing lots at Kure Beach, N. C.

hotel and plant trips; and Harry T. Paterson, entertainment.

Among the companies represented were: Aluminum Company of America; American Machine and Foundry Co.; Bell Telephone Laboratories; Chrysler Corp.; Dow Chemical Company; Wilbur B. Driver Co.; E. I. du Pont de Nemours; Eagle-Pitcher Co.; Electric Auto-Lite Co.; Electric Storage Battery Co.; General Electric Company; General Motors Company; Hanson-Van Winkle-Munning Co.; International Nickel Co.; Kaiser Aluminum & Chemical Co.; Mathieson Chemical Co.; Union Carbide and Carbon Corp.; National Research Corp.; Ray-O-Vac Company; Udylite Corp.; Western Electric Company; Westinghouse Electric Corp.; and Willard Storage Battery Co.

Universities and colleges represented were: M. I. T., Columbia, New York University, Ohio State University, University of Michigan, Rutgers University, Princeton University, North Carolina State, and many others.

The following are abstracts of papers presented at the meeting which are of interest to the finishing field:

Anodic Behavior of Aluminum and Its Alloys in Sulfuric Acid Electrolytes

Ralph B. Mason and Phyllis E. Fowle

This paper deals with the main factors affecting the rate of solution of anodic oxide coatings on aluminum as they are being formed in sulfuric acid electrolytes. Conditions favoring high coating ratios or thick hard abrasion-resistant coatings have been investigated. Low temperatures, high current densities, which permit a shorter time of immersion in the electrolyte, and the addition of substances such as oxalic acid to the electrolyte, favor the formation of such coatings. This has been mainly an investigation of the competition between the rate of formation and the rate of solution of the coatings.

Technicians examining test racks at Harbor Island Corrosion Testing Station.

The Anodic Behavior of Pure Aluminum in H_2SO_4

J. V. Petrocelli

The anodic behavior of pure aluminum in H_2SO_4 at relatively low voltages has been studied. Conventional d-c polarization curves have been obtained; in addition, a-c impedance measurements have been made at each of the various d-c voltages by superimposing a small a-c voltage on the d-c voltage and measuring the impedance with an a-c bridge. The resulting data have been used to calculate the capacitance and resistance at the metal-solution interface. It is shown that these latter parameters may be used in a qualitative way to determine the thickness of the "barrier layer film" and a probable mechanism for the dissolution reaction.

Radiometric Study of the Chromium-Sulfate Complex Formed in Chromium Plating Baths*

Ronald L. Sass and Stanley L. Eisler

Tests conducted to determine the ionic nature of the coordination complex formed and the amount of sulfate so complexed are described. It was found that the chromium-sulfate complex formed is cationic in behavior and can be removed from the plating solution by employing the appropriate ion exchange media. Approximately seven per cent of the total sulfate is bound up in the complex after electrolysis. The formation of a large complex ion is indicated by the fact that the per cent of sulfate regained from the resin column is considerably less than and independent of the amount of trivalent chromium regained.

*The opinions or assertions contained herein are not to be construed as being official or reflecting the views of the Department of the Army.

A Study of the Variables Affecting the Particle Size of Electrodeposited Lead Powder

James B. Crownover and Charles L. Mantell*

At the present time, electrolytic lead powder is not produced in the United States. The three major manufacturers of lead powder, the National Lead Company, Perth Amboy, New Jersey, the Metals Disintegrating Company, Elizabeth, New Jersey, and the Glidden Company, Hammond, Indiana, use atomization processes. To date, very little work has been done on the preparation of lead powder by electrolytic means. It is hoped that this thesis will serve as a starting point and guide for future studies of electrolytically deposited lead powder.

*Present address: Titanium Division, National Lead Company, Sayreville, N. J.

Adherent Electroplating on Molybdenum

Robert M. Hansen and Charles L. Mantell*

Four detailed methods of securing adherent plating on molybdenum are described in detail with regard to preliminary surface preparation and plating methods.

*Present address: Louisiana State University, Baton Rouge, La.

Polarization Studies of Copper, Nickel, Titanium and Some Copper and Nickel Alloys in Salt Solutions

H. B. Bomberger, F. H. Beck and M. G. Fontana

Polarization characteristics were determined for some metals and alloys in flowing salt solutions. Relationships between potential and time, potential and applied current, applied current and corrosion rate, and solution velocity and corrosion rate were considered. Copper and brass anodes dissolved readily. Nickel and copper-nickel alloys exhibited an anodic overvoltage. Titanium anodes resisted dissolution by film growth and extensive polarization.

Electrodeposition of Cellulose

Charles L. Mantell and Frank Cozzarelli

Cellulose has been plated at the anode from solutions containing approximately one per cent of cellulose, where the solvent is an alkaline sodium zincate modified by addition of urea.

Electrodeposition of Nickel-Molybdenum Alloys from Aqueous Solutions*

D. W. Ernst and M. L. Holt

Nickel-molybdenum alloys can be electrodeposited from aqueous solutions containing nickel sulfate, sodium molybdate, sodium citrate, and ammonium hydroxide. The effects of pH, concentration, temperature, and cathode current density on cathode current efficiency and on the composition of the alloy deposits were studied. A plating solution, containing 0.3 mole/liter of nickel sulfate, 0.2 mole/liter of sodium molybdate, 0.3 mole/liter of sodium citrate, and ammonium hydroxide to pH 10-11, showed a current efficiency of about 80 per cent when electrolyzed at 10 amp./dm.^{2} The resulting alloy deposits were bright and adherent, and contained about 20 per cent molybdenum.

*Work done under Contract No. DA 11-022-ORD-556 for the Office of Ordnance Research.

Electrodeposition of Cobalt-Molybdenum Alloys from Aqueous Solutions*

R. F. Amlie and M. L. Holt

Aqueous solutions containing cobalt sulfate, sodium molybdate, and either sodium citrate or malic acid were found suitable for the electrodeposition of cobalt-molybdenum alloys. The effects of pH, concentration, temperature, and cathode current density on the current efficiency and on the composition of the alloy deposits were investigated. The Hull cell was used to obtain qualitative information, and regular plating procedures were used for quantitative information. A comparison of similar nickel-molybdenum and cobalt-molybdenum baths is also included.

*Work done under Contract No. DA-11-022-ORD-656 for the Office of Ordnance Research.

Electrodeposition of a Lead-Tin Alloy Containing Six Per Cent Tin

William S. Fischgrund and Charles L. Mantell*

The most stable solution for depositing a six per cent tin deposit has the following composition: 0.11*N* stannous tin; 0.89*N* lead metal; and 0.5 g./l. peptone. This solution can be operated at room temperatures, and current densities from 10 to 45 amp./ft.^{2} are permissible.

President R. J. McKay (right) presents Palladium Medal to Dr. Nathaniel Howell Furman. Dr. R. M. Burns is seen at the left of the photo.

*Present address: Wright Aeronautical Division, Woodridge, N. J.

Periodic Current Reversal in Plating Copper-Lead Alloys

Nelson W. Hovey, John L. Griffin, and Albertine Krohn

Apparatus based on the commutator principle was designed and constructed to convert direct current to square-wave alternating current, and was applied in electrodepositing copper-lead alloys from a cyanide-tartrate solution. The procedure was successful in eliminating the nodules which occurred in alloy deposits obtained in previous studies using this type of bath.

The Effect of Periodic-Reverse Plating Variables on Density and Electrical Conductivity of Silver

William H. Colner and Harold L. Schick

In a study sponsored by Squier Signal Laboratory aimed at improving microwave surfaces, several variables of periodic-reverse plating were investigated as affecting the density and electrical conductivity (and in some cases, smoothness) of electroformed silver specimens.

The following variables were studied: forward current density, reverse current density, forward to reverse time ratio, cycling speed, bath temperature, presence of brighteners, and annealing. Conditions which maximize density and conductivity were found for both periodic-reverse and direct current plates. With periodic reverse, better properties were obtained.

(*Continued on page* 130)

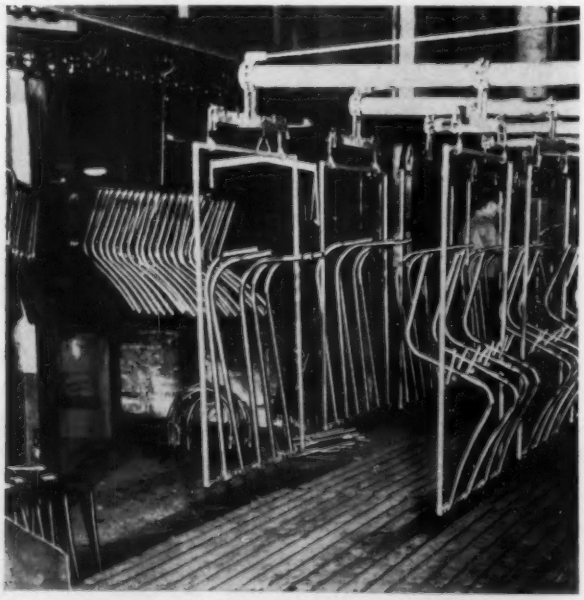
How One Firm Beat the Nickel Shortage

DAYSTROM FURNITURE, division of Daystrom Corp., Olean, N. Y., formerly used nickel plate as a protective base for its chrome-finished furniture parts. When the government cut its nickel supplies, the company switched to previously-untried copper plating. The new process has worked out so well that when the nickel squeeze ends, Daystrom says it will stick with copper plate.

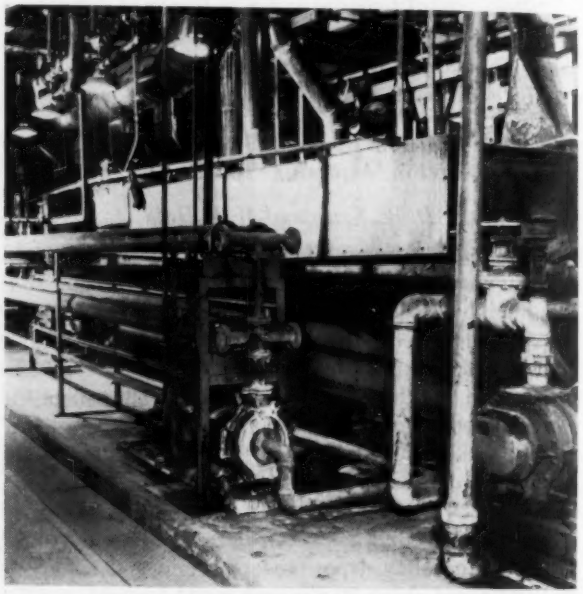
The squeeze was suddenly put on nickel in February 1951 when heavy allocations of the metal were made to the Atomic Energy Commission and producers of jet engines. Most commercial manufacturers of chrome-finished products were stuck when their supplies of nickel were unexpectedly shut off. Daystrom, for instance, had only a six months' supply of nickel on hand at the Olean plant.

Many decisions had to be made and in a hurry. Some chrome finishers switched to white brass plating. Some went so far as to plate chromium directly on steel. For added protection and to hold the color, they would put a lacquer on top of the coating of chromium.

Deciding against any of these techniques, Daystrom engineers soon investigated the possibilities of bright copper plating with periodic reverse. The periodic reversal of current shaves down the microscopic hills and fills in the valleys of copper, leveling off the finished piece. By producing deposits with such sound structure, leveling also increases the corrosion-resistance of the copper. In addition, the PR process operates under high current densities, and deposits heavy coatings of copper in a short time. The high current densities of the process was a particularly attractive feature to Daystrom engineers who were plating irregular-shaped furniture pieces. Some pieces presented target distances to the metal anodes that varied as much as 18 in. At this time, few commercial installations were using PR processing, and none could be found that operated under similar conditions of great differences in current densities. However, the process would give the required bright, fine-grained surface. And experimental work indicated that these surfaces could be put on all furniture parts that the company was plating.



Worker places cold-rolled steel tubing bent in the shape of table and chair legs on the racks of the plating machine. Arms carrying the racks will lift up, swing around the turn of the racetrack-shaped machine to start the plating operation.



Heat exchangers rather than coils in tank bottoms warm the plating solution in this installation. If one exchanger breaks down, the solution may be sent through another exchanger while repairs are made. Tanks need not be shut down and plating operations are not interrupted. This bank of exchangers keeps the copper bath between 180 and 190 deg. F. At right is a 160-cfm blower that sends agitating air into the copper plating tank.

Daystrom engineers soon decided to go along with the PR process, and by July had changed over to copper plating. Changing-over was relatively simple. Daystrom's 40,000-gal. plating machine was installed in 1945. At the time, the machine was then the largest nickel-plating tank in the world. (Since then Ford has installed an 80,000-gal. tank at its Monroe, Mich., plant. It now is the largest nickel bath in captivity.) Nickel plating took place in one machine, chromium plating in a second machine.

First thing the engineers did was to combine the new

copper and chromium plating operations. Since the copper plating necessitated a smaller bath than the nickel for equal thickness of plate, the copper and chromium plating operations were easily placed in one machine. A few other mechanical changes were necessary. These included installing more elevator stations on the new machine and replacing Duriron heat exchangers with steel ones for the copper plating operation. Now, with the new set-up Daystrom can plate 100,000 lineal feet of tubing each day.

Since the summer of 1951, Daystrom had been operating continuously on a 24-hour basis with PR processing. What kind of success have they had? "We get as good or better corrosion-resistance with PR copper than we did with nickel," says *M. E. Kilroy*, head of quality control. "Cost of copper is less than the cost of nickel, but the copper salts cost more. However, there is every indication that over-all chemical costs have stayed the same." Labor costs have dropped. It takes

After copper plating and a rinse, these furniture parts are first given a 50-millionths-of-an-inch nickel coat, then another rinse, and finally a 30-millionths-of-an-inch chrome finish. The parts are then taken off the racks. Next the racks are stripped in an alkali bath of any chrome that may have clung to them.

four men to operate a machine of this size. In the nickel-chrome operation there were two machines, eight men. The copper-chrome operation takes place in one machine; hence requires only four operators.

"It is doubtful whether we will go back to full nickel-plating," says Kilroy. "However, when the squeeze eases we will probably put a nickel coating — maybe up to 0.0003 in. — on top of the copper." At present Daystrom is plating copper — .00075 in., chrome — 30 millionths, and nickel — 50 millionths of an inch, which is the maximum nickel allowable under a recent government directive.

Operation of the Plant

At Olean, the electroplating operation takes place on a 285-ft. racetrack-shaped plating line. It consists of loading the racks with work to be plated, cleaning the work prior to plating, plating with copper on the homestretch, then plating with nickel, plating with chro-

Chrome kitchen set. With the new plating operation, Daystrom can plate 100,000 lineal feet of tubing each day.

mium, unloading the finished parts and finally cleaning and stripping the racks on the backstretch.

Except for loading and unloading, the operation is automatic throughout. A conveyor system carries the work from station to station, a distance of 42-in. Elevators dunk the work into the baths, which are 6 ft. 10 in. wide, at each station. In some baths, the work stays dunked as it moves from station to station. At each station, a piece of work is immersed for 6 sec. It takes 30 sec. to go from one station to the next.

After a part is loaded on the racks of the machine, it passes from tank to tank in this merry-go-round fashion.

1. Electrocleaning tank. Alkaline cleaner. 180°F. Dip time: 42-sec.

2. Spray tank. Room temperature. Plain water. Time: 6 sec.

3. Electrocleaning tank. Same action as the first tank. Time: 42 sec. Solution from this tank is pumped into the first tank at the end of each week. Solution from the first tank is discarded each week.

4. Rinse and spray tank. Removes caustic from work. Time: 6 sec.

5. Rinse and spray tank. Time: 6 sec.

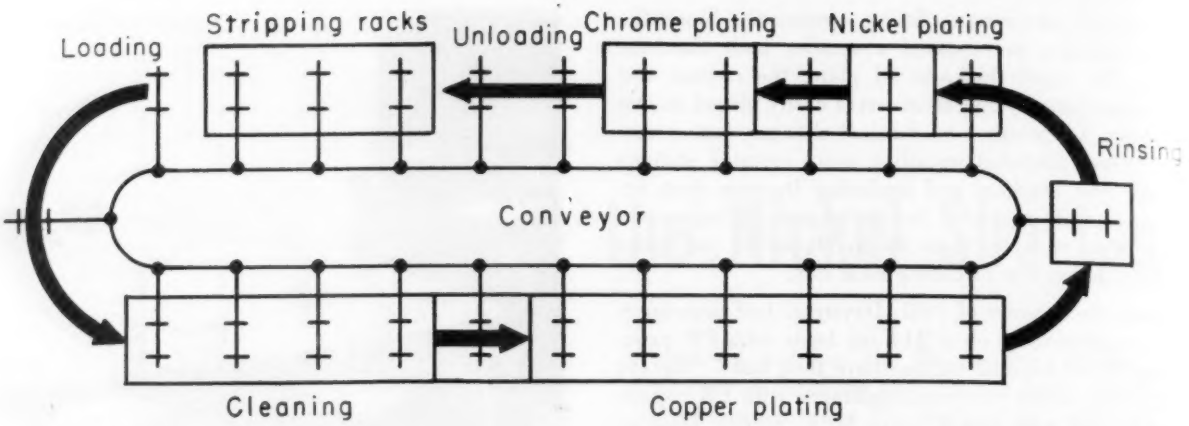
6. Acid dip tank. Sulphuric acid. Removes oxides from work. Time: 6 sec.

7. Rinse and spray. Time: 6 sec.

8. Cyanide dip tank. Concentration: about 10 ounces of sodium cyanide per gallon of water. Cyanide bath neutralizes the acid still clinging to the parts, removes all traces of ferric salts and acts as intermediate between the water tank and copper strike tank. Time: 6 sec.

9. Copper Strike Tank. 140 to 160°F. Time: 42 sec. Bath is about 80 percent efficient. Copper strike tank prepares parts for copper plating and is necessary for good adhesion of the copper to the steel.

10. Copper plate. Time: 13 min. 44 sec. 180 to 190°F. pH is about 12; however, the process is not controlled by pH but by the amounts of materials



Copper plating line showing electrocleaning, spray rinse, cyanide dip, copper strike and copper plating tank. This line is 142.5 ft. long.

added to the bath. Analyses are made periodically to determine the proper amounts to add.

Constituents in the bath are:

Copper	3.0 oz./gal.
Free potassium cyanide	1.5 "
Potassium hydroxide	6.5-7 "
Potassium carbonate	3.0 "

The solution is filtered continuously. At Olean, two 7,500-gph filters turn over the solution in the tank every hour.

There are 23 station stops made by the conveyor passing over the bath. To get the brightest finish possible, the racks and work at the first three and the last two stations are always cathodic. The other 18 stations are alternately anodic and cathodic. Plating takes place at 100 amps./ft.^{2}

This particular proprietary bright copper is air agitated. It was found that air agitation gave brighter deposits than cathode rod or solution circulation. Operating at 5 psi, 160-cfm low-pressure blowers force air through pipes into the plating tanks.

11. Save-Rinse or Reclaim tank. Air agitated. Water going into the reclaim tank is deionized in a 1,000-gph unit. Time: 6 sec.

After deionizing, the water contains unwanted carbon dioxide. Therefore air is bubbled through the water to drive out the carbon dioxide. Water from the reclaim tank is used as make-up water for the plating tank.

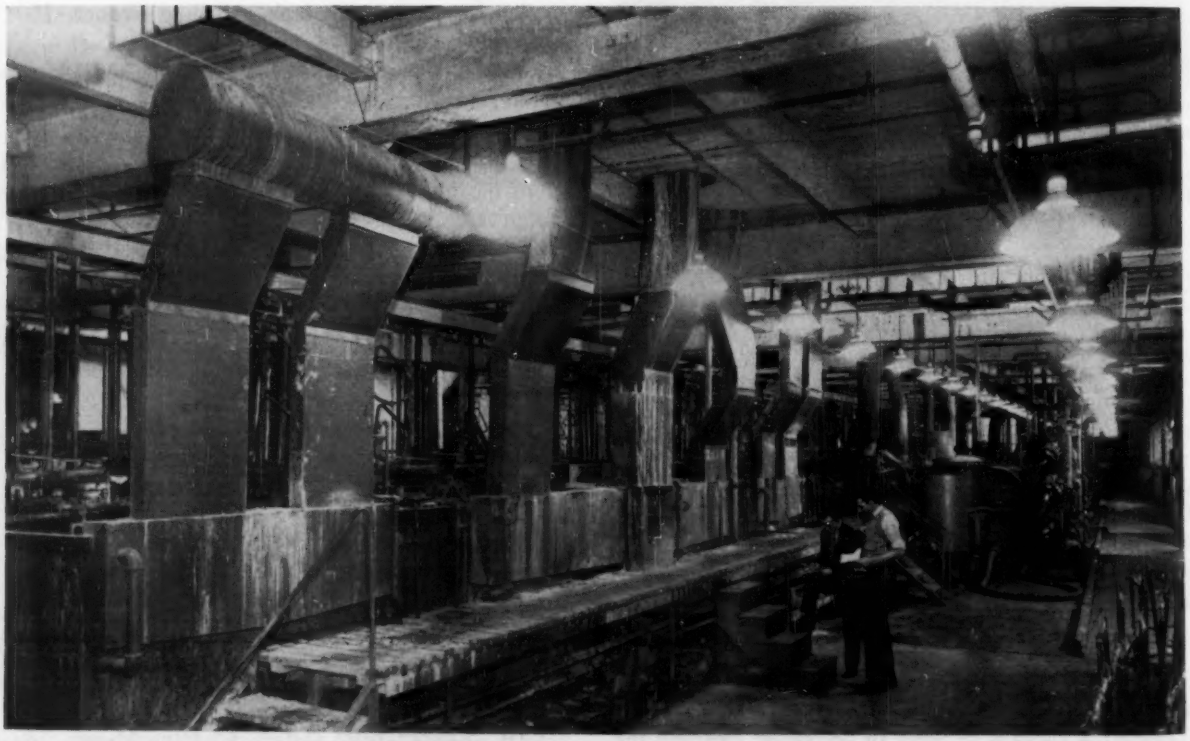
12. Cold rinse. Time: 6 sec.

13. Acid dip tank. Removes all traces of cyanide. Time: 6 sec.

14. Cold rinse. Time: 6 sec.

15. Nickel strike. Time: 42 sec.

16. Cold rinse. Time: 6 sec.



New chrome-plating operation takes place on this 285-ft. racetrack-shaped plating line. Furniture parts connected to carrier arms, like a mechanical rabbit, are first cleaned, then plated with copper, kissed with nickel and finally plated with chromium. The finished parts are unloaded, then the carrier racks are cleaned.

17. Chromium plating tank. This is brick-lined tank. Standard chrome-plating operation. Time: 3 min. 6 sec.

18. Reclaim rinse. Time: 6 sec.

19. Cold rinse. Time: 6 sec.

20. Cold rinse. Time: 6 sec.

21. Cold rinse. Chromic acid is thick and sticky — requires a thorough rinse. Time: 6 sec.

22. Hot rinse — so work will dry fast. Time: 6 sec.

23. Unload. Racks are left on the carrier arms. Time: 3 min., 6 sec.

24. Alkali strip tank. Removes chrome plate at exposed contact points. Concentration of caustic soda: 4 to 6 oz. per gal. Room temperature. Racks are anodic. If chromium were not taken off here, it would later contaminate cleaning baths and plating solutions. Time: 1 min. 54 sec.

25. Cold rinse. Time: 6 sec.

26. Muriatic acid dip. Neutralizes alkali. Time: 6 sec.

27. Hot rinse. Time: 6 sec.

28. Loading station. Racks are added or removed, and work is loaded at this station. Time: 3 min. 6 sec.

A total of six generators supply all the current used in the various cleaning and plating tanks. Three 7,500-amp. units supply current for the 18 periodic reverse stations of the copper bath. Each generator services six stations.

A 10,000-amp. unit supplies the current for the nickel and chrome plating operations. Two smaller generators provide current for the electrolytic alkaline cleaning and electrolytic acids as well as those five stations of the copper bath that are maintained on continuous cathodic operation.

The conveyor on the plating machine has arms extending out over the solution tank. These arms carry two racks on which chair frames, table legs and other pieces of work are quickly loaded or unloaded. At present, Daystrom is plating over 60 different furniture parts on its machine.

The arms are mounted on rollers set in vertical guide channels. The channels are connected to upper and lower endless chains.

Crank-arms lift and lower the work-carrying arms. The chain drive and elevator lift are interlocked so forward motion is obtained only with the elevator in its raised position. The conveyor has 72 carrier arms and the elevator lift is 50 in.

Photos courtesy Hanson-Van Winkle-Munning Co., Matawan, N. J.

EXTRACTS
From the World's Plating Literature

Structure of Metal Surfaces — Investigation of Mechanically and Electropolished Surfaces by the Electron Microscope

H. Raether; *Metalloberflaeche*, vol. 6, No. 8, pp. A113-A119.

A highly polished surface, either mechanically or electropolished or a mirror metal surface deposited from a vacuum is usually regarded as clean and plane but this is only partially correct as is shown by surface examination by the electron microscope. Sounding into the metal by means of a probe to a depth of 1 micron would establish always the base metal and it would be correct with such a finding to say the surface was clean. Such a probe is provided by X-ray examination which penetrates to a depth of 1 micron. For a very important technical group of surface problems as for example phenomena of corrosion and passivity, the adhesion of electroplated coatings and the structure of electropolished and mechanically polished surfaces, the composition of upper layers of the surface and indeed the first 10 Å (10 Å = 0.001 micron) is of outstanding significance so that a probe of 1 micron penetration is much too coarse.

Examination of a mechanically polished metal surface has shown that there are present one to a few elementary cells of degraded metal crystal powder. This particularly strong degraded layer of metal extends only to a depth of a few 10 Å. Under this the crystal size progressively increases until, according to the working conditions, at a greater depth (about some 10 microns) the undestroyed single crystal structure is again reached.

Interesting findings were obtained with the electron microscopic examination of electropolished surfaces. A surface which had been rubbed with emery, was examined and the scratch effect was most clearly discernable, as shown by photographic reproduction. Progressive electropolishing was then given to this surface. Interruption of the electropolishing, giving an incomplete polish, showed that the surface had already been very considerably refined. Further polishing to completion gave an impressively smooth picture of the surface under the electron microscope. The smoothing of the surface which was observed was surprising, a process which is ended after a few minutes treatment. The actual dimensions as measured by the electron microscope showed for electropolished aluminum (99.99%) average roughness values of about 150 Å while the maximum value amounted to about 103 Å. All flasks polished on the wheel gave maximum surface prominences of 4,000 Å and average values of 600 Å. In general it was found and this is not of practical significance, that the electropolished surfaces possess a certain waviness, thus over greater areas are not plane as are mechanically polished surfaces.

With the impression method of Mahl for surface examination, a coating is given to the surface, with lacquer for example, and the dried film is then removed and examined under the electron microscope by transmitted light. Examples of this type of surface

prints of electropolished metal surfaces showed no detail of any kind. The smoothness with a cleavage surface of a crystal is similar and it follows from this that both smoothnesses are comparable. This result was confirmed with recent research on zinc. Examination by the electron interference method allows one to determine (a) How the crystal structure at the surface is constructed (whether single crystalline, coarse or finely crystalline: (b) How smooth the surface is; (c) Whether the surface is covered by a film, thus the surface is not formed by a pure metallic surface. Mechanically polished and electropolished single crystal surfaces were examined by this method. The electropolished surface showed a single crystal structure. Quite differently from the mechanically polished surface, with which the surface structure is completely destroyed, the crystal structure with the electropolished surface consists of the undisturbed structure. The examination showed that the electropolished surface has a surprisingly high smoothness and polish which is approximately plane but which has nevertheless a slight undulation.

Electropolished aluminum (99.995%) showed the interference diagram of aluminum and actually of single crystal aluminum. In spite of this an aluminum oxide or hydrated aluminum oxide coating is present on the surface, whose thickness depends on the polishing electrolyte. The thinnest oxide coating is obtained with the use of perchloric acid-acetic acid anhydride (1:3) as the polishing bath; it amounts to about 10 Å. With the use of phosphoric chromic acid the oxide coating thickness is 50-80 Å, while the perchloric acid-methyl alcohol bath gives oxide thicknesses over 100 Å. With copper in general one obtains with the orthophosphoric acid bath after polishing, interference lines of copper so that a relatively clean surface up to about a possible surface film of about 10 Å of Cu_2O can be considered. With zinc electropolished in the bath orthophosphoric acid plus ethyl alcohol or orthophosphoric acid alone although the metal when taken from the bath shows a highly polished brilliant surface, examination showed that no interference lines of zinc could be seen. The surface was coated with a thickness of more than 40 A presumably of ZnO mixed with reaction products of zinc with the electrolyte. This conditions the passivation of the surface. The results show that an electropolished surface, in spite of the apparent optical perfection, does not always represent a pure metal surface.

Electropolishing Techniques for Non-ferrous and Ferrous Metals

L. Meunier; *Galvano* (Paris), vol. 21, No. 188, pp. 18-21.

The electropolishing of zinc and copper in caustic soda presents certain interesting technical features. Caustic soda is an excellent passivating medium. Huber established that the passivation film on zinc was the oxide. In the case of copper the coating is constituted for the most part of hydroxide; the same holds good for cadmium. These substances are all more or less soluble in concentrated caustic soda. For example in the case of zinc the following reactions occur according to the concentration of the solution:

$$ZnO + OH^- = ZnO_2H^-$$
$$ZnO + 2OH^- = ZnO_2^- + H_2O$$

Similar reactions occur in the case of copper and cadmium but the solubility of copper hydroxide is much less than that of zinc oxide and that of cadmium hydroxide is less still. One could expect accordingly to polish zinc fairly easily in this medium; it would be much more difficult to polish copper and one would only succeed in passivating cadmium. The course of the anodic polarization curves of zinc in more and more concentrated solutions of KOH is very instructive. All have the same general form; the solution of the metal and the disengagement of oxygen are made sensibly at the same potential as would be expected. Only the corresponding current density on the scale increases with the concentration by virtue of the increase of solubility of the oxide film. The technical problem in this case is to increase the solubility of the passivation film in the bath and this is obtained by an increase in concentration. The phenomenon is however complicated by a modification of the structure of the oxide. One can arrive at an analogous result by fixing the concentration at a sufficiently high value and by increasing the temperature. The anode can also be agitated in the solution. In this fashion the fluid coating of diffusion would be thinner and the solution of the oxide would be facilitated. In the case of copper an analogous problem is encountered but the solution of the oxide cannot be increased as much by increasing the concentration. The problem can be resolved by an addition of concentrated ammonia to the bath — the formation of the amine complex facilitates the solution of the oxide.

Regarding the electropolishing of copper and iron in phosphoric acid baths the following can be said. These phosphoric acid baths are technically the most important of the electropolishing baths but in spite of their extended use, relatively little is known about them. The electropolishing of copper is a relatively simple case — the copper is polished in concentrated phosphoric acid at ordinary temperature. The first part of the copper anodic polarization polishing curve, represents the unstable condition of the anode. This is due to the action of local cells in short circuit on the anode which at this moment is heterogeneous. Certain areas are covered by the passivation film responsible for the polishing while others are covered by the film of cuprous oxide. Study of the anodic polarization curves for various solution concentrations show that the normal solution of the anode and the disengagement of oxygen occur at characteristic potentials practically independent of the acid content. Only the current density varies. This increases at first with the solution concentration, passes by a maximum, then diminishes. It will be noted that the conductivity of the bath varies in an analogous manner while the viscosity only becomes appreciable at high concentrations. In dilute solutions the metal passivates itself; it only polishes suitably in concentrated baths. At average concentrations the unstable polishing zone is fairly extended. The technical problem here in this case is to ensure a

good stability of the polishing film and this is only possible if it is sufficiently viscous.

The electropolishing of iron in the phosphoric acid bath represents a more complicated case. Generally a mixture of phosphoric and sulfuric acids is used with small final additions of chromic acid. In the phosphoric acid bath alone, the most favorable composition is of the order of 75 to 80% by volume of acid. But any proportion of this acid can be replaced by an equal quantity of concentrated sulfuric acid, the preference being given to baths rich in H_3PO_4. Study of the bath formulae proposed for electropolishing steel lead to the assumption that the polishing mechanism is sensibly the same in all the mixtures. Steel passivates itself anodically in the cold; it is necessary to heat the bath to obtain a polishing effect. This is an application of the general rule that an increase of temperature diminishes the passivation speed and increases the solution speed of the anodic film. As the temperature of the bath is increased a point is reached at which a stable polishing effect is obtained. There are without doubt other means for improving the bath operation. The role of the addition of chromic acid is not clear. It is difficult to be precise when the structure of the passivation film has not yet been established.

Pickling of Stainless and Heat Resisting Steels

E. Brauns; *Metalloberflaeche*, vol. 6, No. 10, pp. A147-A150.

With the pickling of the high alloy chrome and chrome-nickel steels, i.e. the stainless and heat resisting steels, it is necessary to add an oxidizing agent to the acids. While former practice was to conduct this pickling principally with a mixture of hydrochloric acid and nitric acid, more recent practice is trending towards the replacement of the hydrochloric acid, partially or completely, by hydrofluoric acid. The addition of hydrofluoric acid was first applied for the pickling of the molybdenum-containing chrome-nickel steels which are very difficult to process. Later, it was found that pickling defects, particularly pickling pits, are more easy to avoid in baths containing hydrofluoric acid than in baths containing hydrochloric acid. The pickling pits in the high alloy-chrome and chrome-nickel steels are fundamentally the same phenomena as are known in the field of pitting corrosion. This special pitting corrosion is originated in the presence of halogen ions and, to a particularly strong extent, by chloride ions. By suitable choice of composition of a hydrofluoric-nitric acid pickling bath for these steels, the desired objective can be achieved that only the scale is attacked while the whole metal surface is made practically completely passive and, also, that local activation which gives rise to the undesirable pickling pits, does not occur. The nitric acid serves the function as an oxidizing medium, of inhibiting attack by the hydrofluoric acid on the base metal surface and a high ratio HNO_3 to HF results in a low metal attack. For steels of this class which have not been fully stabilized and which, therefore, have a tendency towards inter-crystalline corrosion, caution is necessary with this bath. Also, when the pickling bath has been allowed to become fairly exhausted, pickling pits can arise.

Special technical interest attaches to the hydrofluoric acid pickling baths which contain ferric sulfate as the oxidizing medium. The ferric salts markedly accelerate the pickling velocity. The maintenance of a definite ratio of ferric sulfate: hydrofluoric acid is very important in order to keep the metal attack as low as possible and to maintain the attack on the scale as high as possible. With correct adjustment of this ratio it is possible to achieve the desired effect that the metal surface is almost completely passivated so that the metal loss in the bath is suppressed to a practically negligible amount.

As this ratio is somewhat critical in practical operation of the ferric sulfate-hydrofluoric acid baths it is necessary to maintain constant analytical supervision of the bath composition in order to obtain the best results and trouble free pickling. The appearance of the pickled ware also gives an indication as to whether the correct bath composition is being employed. If the scale assumes a reddish color during the pickling process, then this is a sign that too small an amount of ferric sulfate is present in the bath. In addition, frequently a noticeable smell of hydrofluoric acid can be remarked. If the pickling time becomes too prolonged without a reddish color of the scale occurring, then this is an indication that the concentration of the hydrofluoric acid has become too low. The consumption of the hydrofluoric acid in the bath is smaller than that of the ferric sulfate. The principal effect of the pickling procedure thus consists in an oxidation of the scale, by which the ferric sulfate is reduced to ferrous sulfate. With a constant scale property of the ware to be pickled, the amount of the ferrous sulfate formed is directly proportional to the finish-pickled surface. If the ferrous sulfate content increases to 20 per cent then the bath must be discarded. About 100 sq. meters can be descaled with 400 liters of bath before the bath must be renewed. With ware covered with light scale, such as would be present due to heating in a protective gas atmosphere the bath capacity could be doubled. The pickling times for light scale amount to around 10-15 minutes and for heavy scale to 30-40 minutes. After pickling in the ferric sulfate-hydrofluoric acid solution, the surfaces of the pickled ware is covered with a dark-colored film, which is removed by treatment in dilute nitric acid and this serves simultaneously as a passivating bath. After this, the ware is rinsed in water in order to remove any adherent acid and finally passed through a pressure spray washer.

The special advantages of the ferric sulfate-hydrofluoric acid pickling bath are several: The metal loss is very low and there is little or no contamination of the surroundings with vapor and spray. These advantages result from the mechanism of the pickling process. According to Recoura, the fluoride ions are bonded to the iron in some form, apparently of a complex nature. It is because of this better bonding that hydrofluoric acid vapors do not occur and that attack of the steel surface by the hydrofluoric acid is inhibited.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Voltage Control in Tin Bath

Question: I am operating 2 tin barrels and 1 cadmium barrel from a 750 ampere, 12 volt rectifier and notice difficulty with anode control in the tin tanks. When one set of anodes has the correct greenish color, the anodes in the other tank turn black. Is there a remedy for this situation?

Also, I have been using the tin strip on brass, copper and bronze, consisting of ferric chloride, copper sulfate and acetic acid, but do not get good results.

F. L. B.

Answer: The regulation of a rectifier is quite poor and loading or unloading of one of your units will result in sufficient change in voltage to affect the state of the tin anodes. The only remedy is an automatic voltage regulator on your rectifier.

For stripping tin we would suggest that you use concentrated muriatic acid.

Zinc Solutions

Question: In our acid zinc and cyanide zinc solutions the anodes are turning black and acquiring a crust. Is there any way this condition can be remedied? Also, how can you test these solutions for "iron" content and how would you remove it or control it?

C. W.

Answer: If the anodes turn black and acquire a crust, it may indicate either impure anodes or something wrong with the solutions. We can't tell from here.

Iron can be determined by any standard method. Procedures will be found in most books on metal analysis. We do not know of any method for removing iron from cyanide solutions. The iron can be removed from an acid zinc solution by neutralizing with zinc oxide and adding hydrogen peroxide, followed by filtering to remove precipitated ferric hydroxide.

Electroformed Screen

Question: In your April, 1950 issue of METAL FINISHING is an article on "Electroforming" by Benjamin Melnitzky. In it he describes the methods and advantages of electroforming for small and odd shaped items requiring close tolerances. We are interested in the electroforming of a very fine gauge nickel screen and would appreciate information as to firms that do this type of work, and whether any such firms are located on the west coast.

M. F. F.

Answer: We know of no firms on the west coast equipped to produce electrolytic nickel screen. However, electroformed nickel screen is available from C. O. Jelliff Mfg. Corp., Southport, Conn., under the name Lektromesh.

Health Hazards

Question: We are compiling information on safety in plating rooms. We are particularly interested in nickel and guarding against rash and allergy from this solution. Also concerned are vapor degreasers, trichlorethylene, sulphuric acid, hydrochloric acid and caustic cleaners. We would appreciate this information from you as quickly as possible.

H. M. K.

Answer: An article on the subject appeared in the May, 1952 issue of METAL FINISHING entitled "Health Hazards in Electroplating Plants," by H. M. L. Murray. The article will probably be of some help.

Acid Copper Brighteners

Question: I have inquired from agents of local supply houses regarding some kind of addition for my acid copper bath that would soften the plate as well as tend to make it brighter. These agents recommend thiourea for this purpose, but we cannot find any information on how much to use or, for that matter, hardly any information on its use or control. Can you give any information on this, or would you suggest some other product? What would syrup or molasses do for my problem, and what quantities in oz./per gal. should I use?

I would also like any information you can offer on the simplest way to remove iron contamination from an acid copper solution. My solutions contain 27 oz./gal. copper sulphate, and 6.5 oz./gal. sulphuric acid.

H. R. H.

Answer: Phillips & Clifton (U. S. Pat. No. 2,489,538) suggested the following solution:

Copper sulfate	250 g./l.
Sulfuric acid	10 "
Thiourea	0.01 "
Wetting agent (Triton 720)	1 ml./l.

This solution requires maintenance of a rather low temperature for optimum results.

Other brighteners which will probably be more suitable for your requirements are 1 pint of molasses per 100 gallons, ⅛ oz. of hide glue per 100 gallons, or a mixture of ¾ lb. phenol and 1 pint sulfuric acid per 100 gallons. The last should be heated in boiling water for 2 hours or let stand for at least 48 hours at room temperature before using as a brightener.

Iron can be removed by adding hydrogen peroxide and then neutralizing the solution with basic copper carbonate. The iron precipitates as ferric hydroxide and may be filtered out but the treatment cost will probably be much more than the value of the solution.

Thomas & Price Anti-Tarnish Method

Question: In your December, 1952 issue, page 74, you made mention of a process developed by Thomas & Price of electrolytically depositing a film of beryllium oxide, to prevent tarnish on brass. Can you give us any additional information on this process?

J. M. D.

Answer: The Thomas & Price method, as modified by Ewing & Jernstedt (Trans. American Electropl. Soc., pp. 105-11 (1940), involves treating the article as cathode in the following solution:

Beryllium sulfate -3-4 g./l.
Boric acid ..... -3-5 "
pH: 5.5-5.9 electrometric
Current Density: 50-100 ma./sq. ft.
Time: 4-6 minutes
Anodes: 7% tin- lead

After treatment, the article should be heated for a few minutes at 275-300 deg.C. The film thickness is stated to be about 0.000004", and will resist tarnish but not abrasion.

Gyro-Finish

Question: We have read with great interest recent literature appearing in METAL FINISHING describing a newly developed polishing and buffing process, as reported, consists of immersing the parts to be polished in a revolving tub of abrasive paste. The paste is composed of abrasive particles dispersed in a liquid vehicle. Although the machine designed for use with this process was briefly described, very little was mentioned about the formulation of the abrasive paste, or of the velocity of the work relative to the paste. It is with this in mind that we request your advice as to the availability of more detailed information regarding this process.

J. H. F.

Answer: An abrasive paste developed by General Motors for polishing zinc base die castings by this process consists of the following:

Liquid buffing composition ... 6 gal.
Water ..... 2½ "
Superfine ground corn cob ...50 lbs.

Water is added, if necessary, to maintain a mosture content of 20-30%.

Rotational speed is about 350 r.p.m. and two drums are used, rotating in opposite directions, for a complete polishing operation. Suitable compositions for other metals require trial and error methods by the user.

Bright Dipping Leaded Brass

Question: My problem is the successful bright dipping of leaded brass. Various combinations of the standard formulas for bright dipping copper and its alloys (as found on page 176 of the 1953 METAL FINISHING Guidebook-Directory), did not satisfactorily brighten the metal. In most cases, any brightness that was obtained was dulled by a very slight etch on the surface. Reversing the standard formula, increasing or decreasing the content of HCl, water, or activated carbon did little to aid the situation.

A dip made up of chromic acid, HCl, and water brought no results, neither did a phosphoric and nitric acid combination. Have you any suggestions along this line? If so, I would appreciate any information you can furnish me.

J. H.

Answer: Leaded brass does not bright dip because of the formation of a lead sulfate smut. Our only suggestion is the peroxide-cyanide combination, which we do not believe you have tried. Make up a 20% solution of sodium cyanide in water. To each gallon of this solution add about ½ pint of 100 volume hydrogen peroxide and immerse the articles. A new addition of hydrogen peroxide is necessary for each batch dipped and, after a couple of batches, you will require a new dip.

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Patents

Recently Granted Patents in the Metal Finishing Field

Chromium Bath

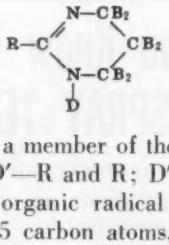
U. S. Patent 2,640,021. *May* 26, 1953. *F. Passal, assignor to United Chromium, Inc.*

A composition of matter for making up an aqueous chromium plating bath comprising essentially chromic acid, strontium sulphate and potassium silicofluoride, there being about 3 parts by weight of strontium sulphate and about 8 parts by weight potassium silicofluoride to 100 parts by weight chromic acid, said composition when dissolved in water being adapted to produce a solution having a concentration of 200 to 500 g./l. chromic acid.

Process for Preventing Corrosion

U. S. Patent 2,640,029. *May* 26, 1953. *C. M. Blair, Jr. and W. F. Gross, assignors to Petrolite Corp.*

A process for preventing corrosion of metals including the step of applying to such metals a substituted tetrahydropyrimidine of the formula type:



where D is a member of the class consisting of D′—R and R; D′ represents a divalent organic radical containing less than 25 carbon atoms, composed of elements from the group consisting of C, H, O and N; R is a member of the class consisting of hydrogen and hydrocarbon radicals, with the proviso that at least one occurrence of R contains from 8 to 32 carbon atoms; B is a member of the class consisting of hydrogen and hydrocarbon radicals containing less than 7 carbon atoms, with the proviso that at least three occurrences of B be hydrogen.

Electroplating Barrel

U. S. Patent 2,640,025. *May* 26, 1953. *A. M. Lazaro.*

An electroplating integral barrel member of heat deformable material consisting of methyl methacrylate adapted to maintain its shape through cycles involving the application of heat, comprising a pair of hexagonal end plates, each end plate having a groove on its inner surface and the said grooves being located adjacent the edges of but spaced from the edges of each end plate and extending parallel to the edges of the end plate, the inner side of each end plate having its face cut away on one side from the periphery to said groove to receive a cover, said end plates being arranged with their grooves facing each other and containing the end edges of an integral hexagonal barrel member of said material having one open side located at the cover side of said end plates, said barrel member having its end edges integrally welded in said grooves of said end plates, the side walls of said barrel being provided with a multiplicity of through apertures for passing electroplating fluid, a cover for the open side of said barrel member engaging the side edges of said barrel member, and means for securing the cover in place, each of the corners of said hexagonal barrel member being provided with a reinforcing complementary filling strip of methyl methacrylate diamond shaped in cross section integrally welded on the inside of said corners to both of the adjacent sheet portions forming the corners thereof substantially throughout the length of said barrel member and terminating at the inside surfaces of said end plates, the projecting apexes of said diamond shaped strips projecting inwardly of the corners to accentuate tumbling action of articles placed within the barrel for electroplating.

Etching

U. S. Patents 2,640,763-7. *June* 2, 1953. *J. A. Easley and H. E. Swayze, assignors to The Dow Chemical Co.*

An etching bath comprising a mixture of a saturated aliphatic acid having from 5 to 26 carbon atoms and an aqueous solution containing nitric acid, the hydroxyl portion of said aliphatic acid being only in the carboxylic grouping.

An etching bath for etching an acid soluble metal comprising a mixture of an aqueous solution containing nitric acid and an ester of an aliphatic acid having from 12 to 18 carbon atoms and a polyhydric aliphatic alcohol having from 2 to 6 carbon atoms.

An etching bath comprising a mixture of an aqueous solution containing nitric acid, an ester of sulfosuccinic acid and an aliphatic alcohol having from 4 to 12 carbon atoms, and a water-immiscible organic liquid substantially unreactive with the aqueous nitric acid solution.

An etching bath for etching magnesium or magnesium-base alloy comprising a mixture of an aqueous solution of nitric acid containing from 3 to 50 per cent of HNO_3 and an ester of sulfosuccinic acid and an aliphatic alcohol having from 4 to 12 carbon atoms, the amount of the ester being from 0.0014 to 0.15 times the amount of the HNO_3 in the nitric acid solution.

An etching bath comprising a mixture of a petroleum sulfonate having from 18 to 30 carbon atoms, a liquid petroleum fraction boiling in the range of 90° to 390°C., and an aqueous solution containing from 3 to 25 per cent of HNO_3 by weight, the amount of the petroleum sulfonate being from 0.01 to 0.2 of that of the HNO_3 in the aqueous solution, and the weight of the liquid petroleum fraction being at least 1.3 times the weight of the petroleum sulfonate but not more than 0.15 of the weight of the aqueous nitric acid solution.

Method of Producing Reinforced Wire Netting

U. S. Patent 2,640,789. *June* 2, 1953. *J. Hausner.*

The method of producing reinforced wire netting which comprises immersing a wire screen of a metal of higher electromotive force and higher melting point than copper in a relatively concentrated aqueous solution of crystal-

fine copper sulphate and sulphuric acid to produce a metal coating upon said screen, and heating the coated screen in a non-oxidizing atmosphere at a temperature sufficient to fuse the coating upon the wire screen and to braze the wires at their intersections.

Fused Bath Descaling

U. S. Patent 2,641,559. *June* 9, 1953. *M. H. Pakkala and F. J. Phillips, assignors to U. S. Steel Corp.*

The process of cleaning ferrous articles which comprises contacting the articles with a fused mixture relatively free of moisture and organic matter, consisting essentially of the following composition given in percentages by weight:

	Per cent
Alkali metal nitrate	40 to 99.9
Alkali metal nitrite	0 to 60
Alkali metal oxide (containing at least 2 atoms of oxygen per molecule)	0.1 to 5.0

A cleaning bath for an oxide-coated ferrous metal article which consists essentially of a fused mixture relatively free of moisture and organic matter, having substantially the following composition in percentage by weight:

	Per cent
Alkali metal nitrate	40 to 99.9
Alkali metal nitrite	0 to 60
Alkali metal oxide (containing at least 2 atoms of oxygen per molecule)	0.1 to 5.0

Wheel Balancer

U. S. Patent 2,641,877. *June* 16, 1953. *S. F. Anderson, assignor to Ralph F. Anderson*

An attachment for balancing an abrasive wheel comprising disks of generally circular outline arranged in face to face relation, each having a central opening for the reception of an arbor carrying an abrasive wheel, each of said disks having a portion of the metal thereof removed along one radius of the disk to produce unbalance along a diameter coinciding with said radius, at least one of said disks being dished to provide a peripheral coplanar face on one side of the disk for engagement with the wheel and to space the central portion of the disk from the wheel, graduations along the periphery of each disk extending from directly opposite the aforesaid radius through ninety degrees, the gradu-

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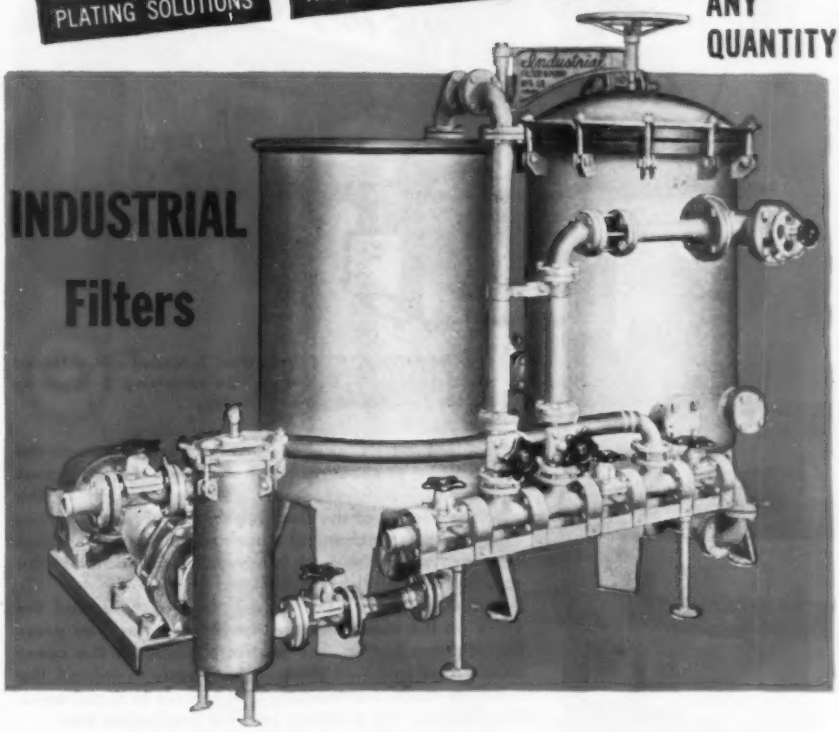

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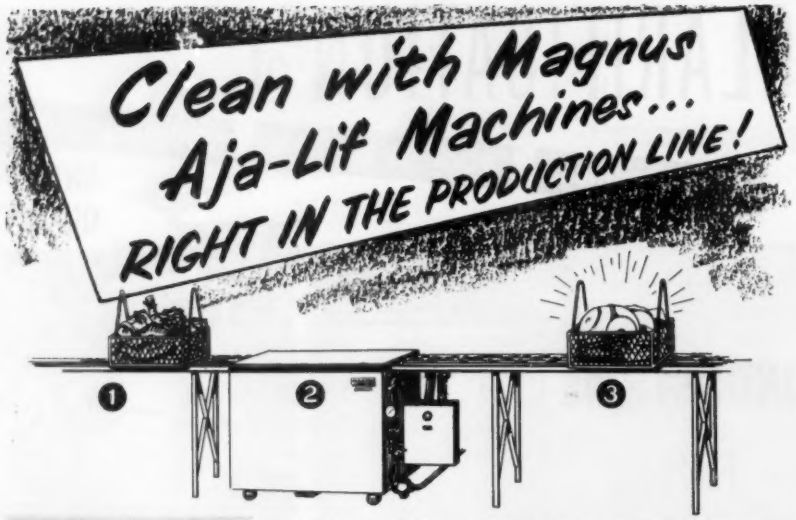
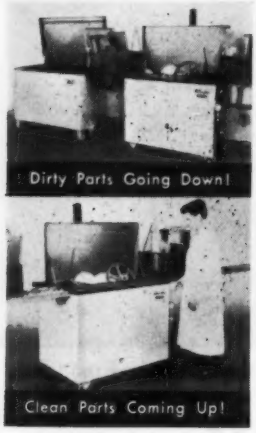




AJA-LIF IN PRODUCTION LINE. Work is loaded and unloaded at top of machine. 1—Dirty parts from processing; 2—Cleaning in Aja-Lif; 3—Cleaned parts to finishing.

Magnus Aja-Lif Cleaning Machines bring you all the advantages of speed and thoroughness of the Magnus Aja-Dip principle of metal cleaning. Added to the chemical action of the cleaning solution is the vigorous and effective mechanical scouring and shearing action obtained while the work is moved up and down in the solution 90-180 times a minute.

***In addition,* with the Aja-Lif Machine, you load the work on the machine at waist level. When you press the starting button, the platform drops as the cover closes, and agitation starts. When ready to unload, the machine stops and the platform returns to waist level. The machine fits perfectly into the production line!**

COMPRESSED AIR OPERATED . . . no gears, speed reducers or belts. No motors or electrical connections. Heating source to meet your needs.

WRITE FOR BULLETIN AL-701, containing the complete story on this unique metal cleaning machine.

MAGNUS CHEMICAL CO., INC.
11 South Ave., Garwood, N. J.
In Canada: Magnus Chemicals, Ltd., Montreal
Service Representatives in Principal Cities

magnus

substantially flat workpiece is polished by passage between a driven abrasive surfaced contact roll and an idler roll the steps of dressing said roll comprising periodically removing said abrasive surface from said contact roll applying an abrasive surface to a plane member having the thickness of said workpiece and passing said plane member between said contact roll and said idler roll with the abrasive surface of said plane member in pressure contact with said contact roll to thereby effect abrasion of said contact roll.

Buffing Composition

U. S. Patent 2,642,348. *June* 16, 1953. *H. A. Stier, assigner to E. E. Seeley Company.*

The method of making a metal-polishing composition, which consists essentially of heating from about 15 to 35 parts, by weight, of a mixture of tri-glycerides belonging to the group consisting of palmitin, stearin, olein and myristin containing from about 3% to 10%, by weight of such mixture, of free fatty acids, with about 65 to 85 parts, by weight, of finely powdered Vienna lime to a temperature above the melting point of the tri-glycerides while thoroughly agitating the mass, then delivering the mixture into molds and immediately chilling the same therein sufficiently to solidify the tri-glyceride content thereof, removing the resultant cast product from the molds and exposing the same to a moist atmosphere until a moisture-impervious skin-coat of an insoluble soap of a thickness of but a small fraction of an inch but not less than about $\frac{1}{64}$ of an inch has formed in situ on such cast product.

Apparatus for Determining Coating Thickness

U. .S Patent 2,642,537. *June* 16, 1953. *K. G. Carroll and D. S. Miller, assignors to U. S. Steel Corp.*

Apparatus for determining the thickness of tin coating on a ferrous base sample comprising a support for said sample, an X-ray tube arranged to direct a primary X-ray beam on the ferrous base, a radiation detector arranged on the same side of the ferrous base for detecting iron fluorescent radiation, means for rotating said support to change the angle between the detector and ferrous base independently of the X-ray tube, and a man-

ations being identified by indicia progressing in opposite directions, and means for supporting the disks for rotary adjustment with respect to each other about the axis of the central opening.

Treating Pickling Wastes

U. S. Patent 2,642,334. *June* 16, 1953. *A. L. Nugey.*

The process of treating liquid industrial waste containing sulphuric acid and ferrous sulphate, consisting in adding sodium hydroxide in sufficient quantity to neutralize the acid to the liquid and agitating the mixture, filtering and removing the iron hydroxide filter cake, heating the latter to form iron oxide and water, adding oxide of lime to the liquid filtrate in sufficient quantity to convert the filtrate into a liquid mixture of calcium sulphate and sodium hydroxide and agitating the mixture, filtering said last-named mixture to remove the calcium sulphate, returning part of the sodium hydroxide in said last-named mixture to replenish the sodium hydroxide originally used, and treating the remainder of the second filtrate with heat and carbon dioxide to form sodium carbonate.

Method for the Uniform Dressing of Contact Rolls

U. S. Patent 2,641,872. *June* 16, 1953. *C. H. Boehm, assignor to Houdaille-Hershey Corp.*

In a polishing operation wherein a

ganese filter between the detector and ferrous base.

Porcelain Enamel for Aluminum

U. S. Patent 2,642,364. *June* 16, 1953. *W. R. Beatty and O. A. Short, assignors to E. I. du Pont de Nemours & Co.*

A vitreous enamel composition suitable for the coating of aluminum and aluminum-rich alloys to provide a mat enamel finish thereon which comprises an enamel flux and 12 to 50%, based on the weight of said flux, of a refractory material added as a mill-addition agent, said flux comprising:

	Mole per cent
PbO	10 to 18
SiO_2	38 to 65
Li_2O	5 to 12
Na_2O	0 to 22
K_2O	0 to 20
TiO_2	0 to 20
Sb_2O_3	0 to 5

the total alkali metal oxide content

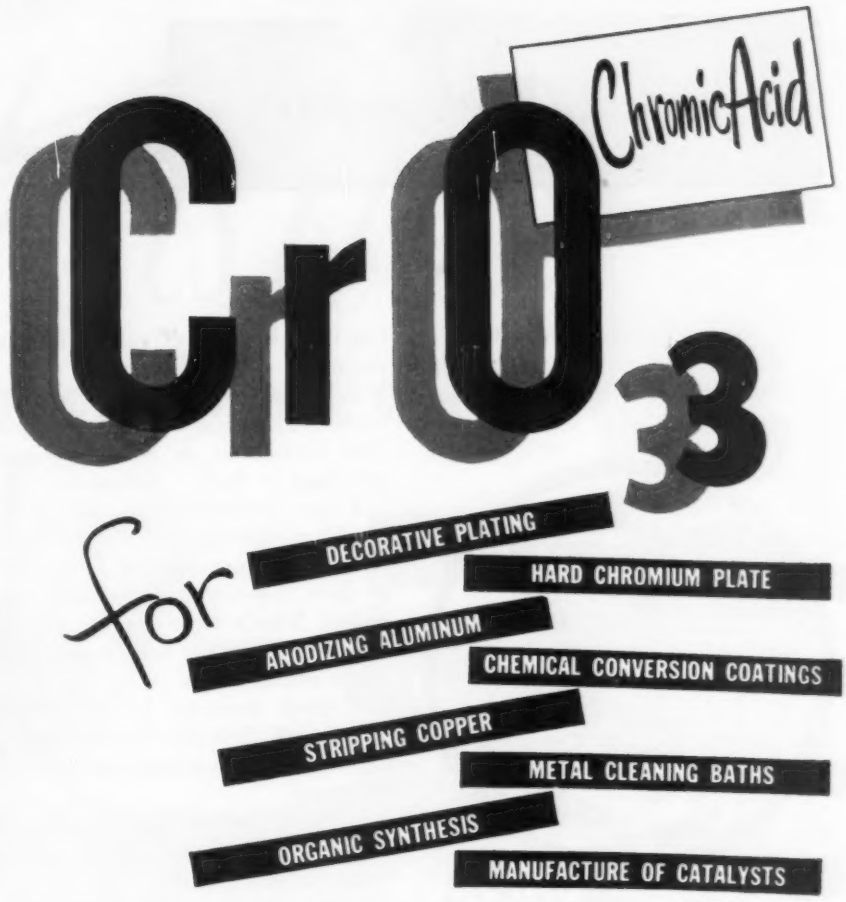
$(Li_2O+Na_2O+K_2O)$

of said flux being between 25 and 36 mole per cent, and the ratio of the sum of said silica content and twice the said titanium oxide content of the flux to said total alkali metal oxide content being between 1.8 and 3.0, all of said oxides being melted into said flux composition.

Hot Dip Coating

U. S. Patent 2,642,368. *June* 16, 1953. *D. Y. Wallace and L. R. Mansell.*

In the art of applying to metal articles a coating of a dissimilar metal by dipping the articles into a bath of the dissimilar metal in molten form, which bath is maintained in a receptacle of metal different from the metal of the bath, in which bath a direct current of electricity tends to flow between the metal of the bath and the metal of the receptacle as a natural phenomenon tending to result in formation of dross consisting mainly of an alloy of the two metals and cause deterioration of the receptacle and contamination of the bath, the step of counteracting such deterioration and contamination by setting up between the metal of the bath and the metal of the receptacle a counter potential of direct current electricity inhibiting the tendency of said direct current of electricity to flow between the metal of the bath and the metal of the receptacle.



● The Mutual name and trade mark on a Chromic Acid drum guarantee a product with a minimum assay of 99.75% and a sulfate content not exceeding 0.1%. Chromic Acid of that purity may be used with confidence in any of the above applications.

MUTUAL CHEMICAL CO. OF AMERICA

SINCE 1845 270 Madison Avenue New York 16, N. Y.

Plants: Baltimore - Jersey City

Galvanizing Apparatus

U. S. Patent 2,642,834. *June* 23, 1953. *W. S. Pearson, assignor to Clifton Conduit Co., Inc.*

In combination in galvanizing apparatus, an impeller ring comprising a simple rim having a series of radial impeller pins thereon, a grooved pulley supporting and driving said impeller ring, means cooperating with said impeller ring to maintain the ring in driving engagement with the pulley, and guide means cooperative with the pins on said impeller ring for guiding articles to be galvanized as they are impelled through a galvanizing bath by said pins in the rotation of the ring by said pulley.

Silver Recovering and Collecting Device

U. S. Patent 2,643,108. *June* 23, 1953. *H G. Lieberman.*

A device for precipitating and recovering silver from a liquid containing silver ions in solution, comprising a receptacle having sides and a bottom formed of thin porous material, an assembly positioned within the receptacle and formed of insoluble material reactive with the ions, said assembly having continuous substantially vertical passages, means to maintain the assembly above the bottom of the receptacle whereby precipitated material may fall through the passages and be collected on said bottom of said receptacle.

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Buff 'n Polish Calculator

Schaffner Mfg. Co., Inc., Dept. MF, Schaffner Center, Emsworth, Pittsburgh 2, Pa.

The above firm makes available on request its handy calculator, designed to answer buffing and polishing problems with a flick of the thumb. By turning the pointer to the material to be buffed, the proper compound, buff and surface feet per minute can be seen at a glance. A handy chart to keep at hand on the job.

New Bright Nickel

Hanson - Van Winkle - Munning Co. Dept. MF, Matawan, N. J.

The development of a new bright-nickel process called Nickel-Lume has been announced by the above company. The new organic-type process is claimed to produce better and brighter nickel coatings, is cheaper to operate and is easier to control than other commercial bright-nickel processes now available.

Both installation and operating costs are stated to be lower. Equipment suitable for a Watts nickel bath is all that is required. Ordinary auxiliary equipment may be used, filtration may be either periodic or continuous, ventilation is not required and heat demands are up to 25% lower.

Characteristics claimed for deposits with the new process are:

1. A bright white color approaching the whiteness of cobalt-nickel deposits.

2. Well-leveled surfaces, reducing surface roughness by 50% and over. This cuts down or eliminates costly polishing or buffing operations.

3. Low internal stress. To prevent cracking, crazing and lifting of deposits, the compressive or tensile stress in these deposits may be easily controlled. What's more important, stress may be held within satisfactory limits as the solution ages.

4. Good ductility. In comparative nickel tests, foils have shown surprising ductility, which continues after the bath ages.

5. Highly active surfaces. Deposits accept chromium without any activating treatment.

Baths may be operated from room temperatures up to or beyond 140°F. with full deposit brightness. With moderate to high current densities, a temperature beyond 120°F. is seldom required.

Current densities may be varied from 5 a.s.f. to above 70 a.s.f. Because of this wide range, uniformly bright deposits may be plated on intricately-shaped articles, and plating speed may be changed to meet various specifications and production schedules.

Nickel-Lume, which has been thoroughly production tested on both automatic equipment and in a job shop, has overcome many limitations of present organic-type nickel processes.

Heavy Duty Electrolytic Cleaner

Klem Chemicals, Inc., Dept. MF, 144001 Lanson, Dearborn, Mich.

More thorough removal of stubborn and heavy deposits of organic and inert foreign matter from metal surfaces preparatory to plating is facilitated by use of Klem Cleaner "197."

This new heavy duty electrolytic cleaner is for use on ferrous metals and may be used with either direct or reverse current. It also is reported to have exceptionally high conductivity qualities and long life.

Polishing and tumbling compounds that harden and are difficult to remove from pits and crevices are among the types of soil more readily freed by the gases when the material is added in concentrations of 2 to 8 ounces to the gallon of water. It is shipped in dry powder form and sold by the hundred weight. For further information, address the manufacturer.

Siliconized Rust Preventive Oil

The Mitchell-Bradford Chem. Co., Dept. MF, 2446 Main St., Stratford, Conn.

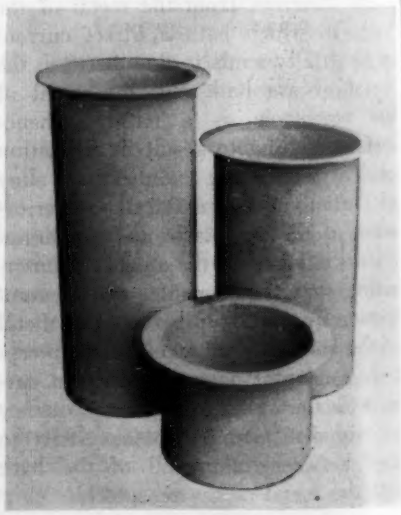
The above manufacturer announces the development of a new product "Siliconized Witch Oil," a rust preventative that gives extra protection and better lubricating qualities to parts.

When applied over a black oxide, phosphate or other type of finish a greater corrosion resistance is assured at a much lower cost per hour of protection. The oil is ideal for protecting work in process or finished parts in storage.

Reinforced Plastic Crocks

Schori Process Div., Ferro Co. Corp., Dept. MF, 8-11 43rd Road, Long Island City 1, N. Y.

The above firm announces the man-



this is it!

THE NO. 1 GREASELESS COMPOSITION

for

POLISHING

BUFFING

BURRING

SATIN FINISHING

TOP QUALITY ABRASIVES • GLUES • BLENDING

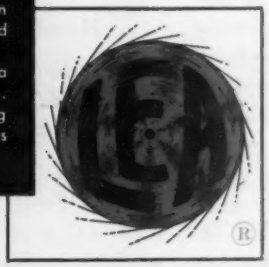
For thirty years LEA has been THE NAME in the field of clean, efficient and economical finishing of metals, plastics and wood, with LEA COMPOUND leading the way . . . all the way. No products are superior to LEA products anywhere because they're developed by Specialists in Finishing and the best materials are used. The LEA laboratory offers careful analysis of your finishing problem and the RIGHT solution to it.

There's a Lea **COMPOSITION** *for* **EVERY** *surface finishing job.*
Just write us about yours.

Yes, Lea Compound leads the way with some other well-known LEA PRODUCTS serving industry everywhere such as LEAROK • LEA LIQUABRADE • AD-LEA-SIVE • LEABRAMENT LEA SPRAY GUN MOVER • LEA LIQUALUBE • cLEAn GRAIN LUBAR • LEA GRIPMASTER LEA LAPPING PASTE • LEA LUBAR

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions.

Manufacturers of Lea Compound and Learock . . . Industry's quality buffing and polishing compounds for over 30 years.



THE LEA MANUFACTURING CO.

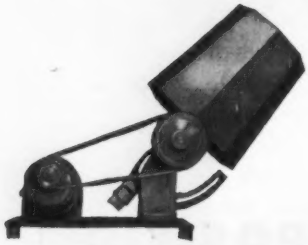
16 Cherry Ave., Waterbury 20, Conn.

LEA-MICHIGAN, INC.	LEA. MFG. COMPANY OF CANADA, LTD.	LEA-RONAL, INC.
14066 Stansbury Avenue	370 Victoria Street	42-48 27th Street
Detroit 27, Michigan	Toronto 2, Canada	Long Island City 1, N. Y.

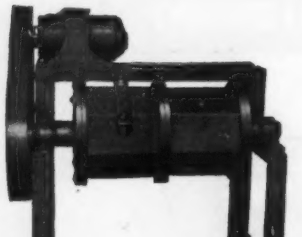
LEA GRIPMASTER® POLISHING WHEEL CEMENT matching the high quality of other Lea Products is now available through LEA-MICHIGAN, INC., 14066 Stansbury Ave., Detroit 27, Michigan

ON SMALL JOB LOTS

FINISHING COSTS TUMBLE



TILT-TYPE BENCH MODEL — motor or belt driven. Adjustable elevation. Steel, wood, rubber lined or alloy metal barrels.



HORIZONTAL FLOOR MODEL — light duty for bulk tumbling and burnishing of small parts.

. . . . when you use a Henderson Oblique Tilt-type Bench Model Tumbling Barrel.

Ideal for SMALL-LOT FINISHING and SAMPLE LOT PRODUCTION of jewelry, clock parts and similar products requiring a *quality finish at minimum cost.* Widely used in laboratory experimental work.

ALSO HORIZONTAL TUMBLING BARRELS — both light and heavy duty for small-lot and quantity production.

Tumbling barrels for every purpose or, made to order to meet your special requirements.

Write now for further information.

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

THE HENDERSON BROS. COMPANY
135 S. LEONARD ST., WATERBURY, CONN.

ufacture of crocks made of Iolyte, a fiberglas reinforced polyester laminate.

The material is a chemically-resistant structural plastic that cannot break or crack as glass and ceramic crocks so easily do. Although this plastic has the tensile strength of steel, pound for pound, it has only one-fifth its weight. No molds are needed so the crocks are cylindrical in shape, not tapered and they are inexpensive.

The crocks are available from stock in capacities ranging from 5 to 125 gallons; diameters from 9″ to 28″; heights from 12″ to 48″. Special sizes are made to order.

Lead Plate Type Heater

Knapp Mills, Inc., Dept. MF, 23-15 Borden Ave., Long Island City, N. Y.

A new lead plate type heater for low pressure steam work in the chemical and process industries has recently been announced.

Engineers have long recognized the desirability of plate type heaters because they are compact, strong, relatively light in weight, and because they provide the largest practical square footage of heating area in the smallest space.

Plate heaters made of steel and steel alloys have been available for years. It is believed, however, that this is the first successful lead plate heater. Lead has exceptionally good corrosion

resistance to sulphuric, phosphoric, chromic sulphurous acids, sulphates and the like. In order to produce the new heater the company had to overcome severe fabricating problems, but the firm is now in a position to produce them in volume.

Recommended for use with 10 lbs. of steam or less, they are available in three standard sizes. The firm's engineering department will also design special units to adapt the heater to unusual working conditions. The following are the dimensions of the three standard heaters:

	Dimensions				*Surface Area Square*
Type	A	B	C	D	*Feet*
1	24″	9″	12″	3″	6.6
2	36″	9″	21″	6″	9.9
3	48″	12″	24″	12″	13.2

Wheel Balancer

Anderson Bros. Mfg. Co., Dept. MF, 1907 Kishwaukee St., Rockford, Ill.

The Speedi-Balancer, an all-steel, dual disc arrangement, does fast, accurate balancing of all types of grinding, polishing and buffing wheels, the manufacturer claims. The unit acts as a substitute collar on one side of the wheel and is easily removed or replaced as needed.

Hand Cream Dispenser

Mine Safety Appliances Co., Dept. MF, Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

A special dispenser designed to fit jars of "Fend," barrier creams widely used to protect plant and factory workers against industrial dermatitis, is announced by the above firm.

Depressing the plunger in the cap dispenses a small amount of cream, the announcement explains. The dispensing unit is suitable for all this line of protective creams except "Fend I."

The list price of the new dispenser is 50 cents. However, one dispenser is furnished free with each dozen jars of cream and may be ordered by the designation, Part No. FC-34760.

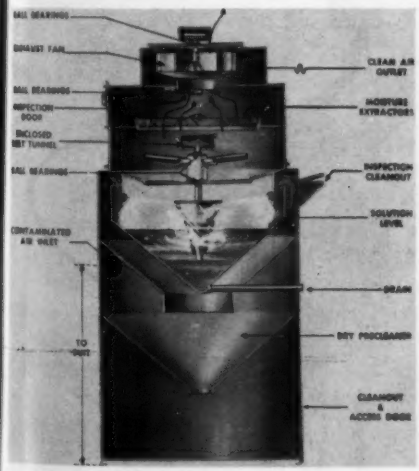
Vertical Rotor Dust and Fume Eliminators

Schmieg Industries, Inc., Dept. MF, P.O. Box 4701, Detroit 34, Mich.

New Centri-Merge Vertical Rotor wet type dust and fume eliminators for industrial applications are now being manufactured. One unit is used for wet collection and elimination only, while the other is a combination primary dry and secondary wet collection unit. The latter has a built-in dry type pre-cleaner for dry collection of heavier and most fine particles, and is particularly useful where material salvage is an operational requirement.

Both units combine the cyclonic principle of dust separation and positive high pressure water action to remove impurities from the air in a rotating torrent of water. For certain applications, say company engineers, other liquids than water may be used. Capacities range from 500 to 50,000 C.F.M.

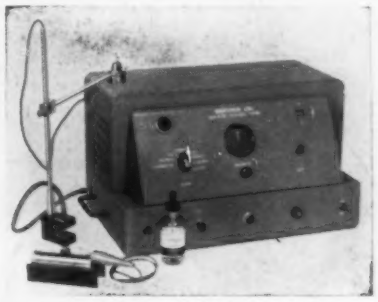
Advantages of the new Vertical Rotor equipment are stated to be low ratio of power to rated capacity, high ratio of water circulated to air volume handled, an independently driver rotor and fan to permit adjustments to meet load and operating conditions, automatic liquid level control, self-acting skim-off of floating particles collected in the tank, collection and elimination functions not affected by water failure, and optional location of air inlet arm. The units are available with an integrally constructed fan or they may be arranged for standard fan installation.



Disposal of material collected in the tank is by drag conveyor, hopper tank skim-off, or manual clean-out. After cleaning, excess moisture is removed from the air by extractors. Clean-out doors, located on the outside of the units, permit cleaning while in operation. Bearings are arranged so that they are out of the liquid and are enclosed in dust-tight covers. They may be lubricated from the outside.

HERE'S WHY

it's easier to do your thickness testing with the



KOCOUR Electronic Thickness Tester

1. Thickness testing is no longer a tedious, time consuming task. Tests require only about a minute to make.
2. Very simple to operate . . . no highly skilled technicians are required.
3. The instrument is virtually automatic . . . readings are direct . . . the human element does not affect the accuracy which ranges from 90-95%.
4. The minimum thickness which can accurately be determined is 5 millionths of an inch (5 ten-millionths of an inch for chromium).
5. Requires no graphs, no charts, no standards or calculations.
6. Magnetic properties of either the base metal or the plating do not affect the test in any way.
7. Guaranteed satisfaction.

• **Operation 105-125 Volts, 60 cycle A. C.**

~ ***Write today for complete information*** ~

KOCOUR CO.

4802 S. St. Louis Ave.
Chicago 32, Illinois

• *Pioneers & Specialists in Test Sets & Instruments for the electroplating industry since 1923.*

Specify* KOCOUR TEST SETS *from your supplier.

Fire Preventive Cleaning of Production Parts

Protectoseal Co., Dept. MF, 1920 South Western Ave., Chicago 8, Ill.

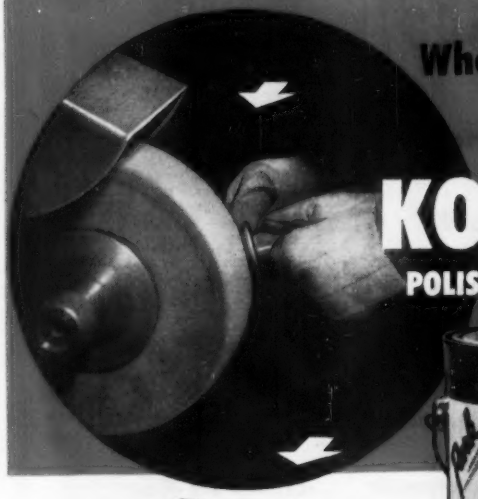
A new approved foot treadle fire preventive dip tank for washing castings, parts, assemblies and similar moderate size production pieces has been developed by the above company. The dip tank is waist high for convenient use without bending and because of its fire preventive construction, it may be placed safely beside the worker or at any other location in the plant where it is most convenient for time saving production. It is made of heavy terne plate electrically seam-welded into a "one-piece" unit and is mounted on a rugged, well-

Wheels CUT FASTER, LAST LONGER

When treated with Park

KOLD-GRIP

POLISHING WHEEL CEMENT



KOLD-GRIP Polishing Wheel Cement, laboratory-controlled through every step of production, will arrive at your plant *ready for use!* Viscosity is constant, regardless of normal temperature variations and the cement can be applied directly from the container . . . *without mixing or heating.* Kold-Grip is clean, odorless and very easy to handle.

Coarse or fine-grain abrasives set up right for fast cutting efficiency. Substantial savings are effected through longer over-all wheel life, fewer set-ups and reduced wheel inventory.

Wheels dry rapidly, are unaffected by humidity changes, and may be stored in any convenient plant area.

Let our polishing engineer demonstrate Kold-Grip for you, or send for free sample, telling us the metal to be polished, grain sizes to be used, and drying facilities available. We can help you if we hear from you.

Park CHEMICAL COMPANY 8078 Military Detroit 4, Mich.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

LICENSED MANUFACTURER: Electric Resistance Furnace Co., Ltd., Weybridge, Surrey, England

HARTFORD *TRIPLE ACTION*

CUTTING *and* TUMBLING BARRELS

for better work in less time!

For uniform cutting down, wet or dry grinding, tumbling, pulverizing and mixing, the unique design of Hartford Triple Action Barrels saves time and money and produces better results. Hartford Barrels give a TRIPLE ACTION in tumbling the material, an "over and over, end to end, folding-in" motion combined, which quickly grinds off burrs, and finishes and smooths the general surface of any article in the load. These barrels are available in two sizes, large and small, and with both motor and belt drive. Hartford also makes steel burnishing balls scientifically correct in design and material for each specific job. Bulletin on request.

THE HARTFORD STEEL BALL CO.

HARTFORD 6, CONN.

DETROIT	CHICAGO	NEWARK, N. J.	LOS ANGELES, CAL.	EXPORT
W. S. TURNER	VICTOR R. CLARK	GUARANTEE TRUST BLDG.	E. O. MALTBY CO.	R. A. RODRIGUEZ, INC.
445 NEW CENTER BLDG.	605 W. WASHINGTON BLVD.	972 BROAD ST.	1718 SOUTH FLOWER ST.	55 W. 42ND ST., NEW YORK

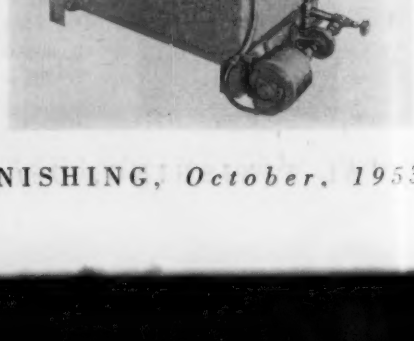
braced welded angle iron frame. The hinged cover is self-closing and the tank remains covered to protect the cleansing solvent from fire or contamination, and to minimize loss by evaporation. It can only be used while the foot is on the treadle; when pressure is relieved the cover closes quickly. Use of the tank is quick and simple; the worker carries the part to the tank, steps on the treadle, washes part and removes foot to close cover all in one time-saving operation without extra movements or waste motion and the convenient height prevents fatigue build-up due to repetitive bending. Should a fire occur in the flammable solvent while operator is cleaning parts, the removal of the foot will close the cover and quench the flame instantly.

The tank is 13″ wide x 24¾″ long x 8¾″ deep and stands 33″ from the floor. It has a working capacity of 8 gallons of cleaning solvent and is equipped with a drain plug for efficient cleaning and drainage. It is approved by Factory Mutual Fire Insurance Companies Laboratories.

Compact Vapor Degreaser

Manufacturers Processing Co., Dept. MF, 1360 Hilton Rd., Detroit 20, Mich.

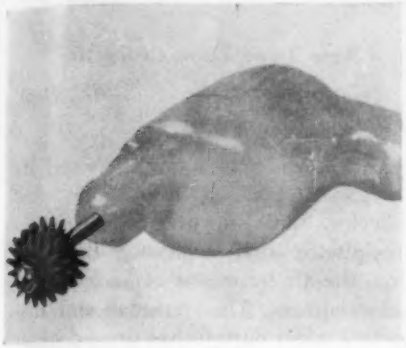
The recently introduced Manpro B-121 vapor degreaser provides quick, thorough vapor cleaning with one compact unit. Dirty parts or assemblies are clean, warm and dry in less than 50 seconds. Outstanding features are 2 vapor controlling condensers: large work clearance: 31″ long, 20″ wide, 16″ deep; divided tank to pro-



vide oil sump and spray pump sump; pressure spray; and the Manpro Bar-L Unit which has 2 safety thermostats. Easily installed in 15 minutes, the unit requires only 220 v. single phase electrical outlet and standard water supply. Normal capacity is 500 lbs. of steel per hour. Prices at $534 F.O.B. Detroit.

Power Buffing Tool

Magic Chemical Co., Dept. MF, 121 Crescent St., Brockton, Mass.



A new power buffing tool has just been developed, which fits into and is powered by most any portable electric drill. Named the Magic Buffer, this tool has many uses throughout industry in plant maintenance and production departments.

Originally, the buffer was developed to condition conveyor belts for applications of repair coatings. Tests and case histories have shown, however, that the buffer is ideally suited for various applications in many industrise. It gives a rough or matted surface to many materials, such as iron, steel, fabrics, leather, wood, concrete. It is also being used to remove imbedded rust from iron and steel surfaces In this way, it prepares the surface for further protective treatments or coatings. It is sturdily built of hardened steel and will stand rugged use.

Color Coded Barrel Finishing Compounds

Tumbling Sales & Service Co., Dept. MF, King St., Greenwich, Conn.

The above firm announces that each product in their line of barrel finishing compounds is now furnished in its own distinctive color. Each color approximates as closely as possible the pH characteristics of the individual compound and serves as a rough guide as to whether the product is acid, neutral or alkaline.

This exclusive Esbec feature is a

Are you SURE you're using THE MOST EFFICIENT FINISH?

If your production involves finishing zinc, cadmium, aluminum or cuprous metals, you owe it to yourself... and your customers... to investigate

IRIDITE®

for on any of these metals Iridite gives you a high performance finish at a low cost from a simple chemical dip.

IF YOU WANT HIGH CORROSION RESISTANCE, you'll find an Iridite that will meet any military or civilian specifications for chromate finishing.

IF PAINT ADHERENCE IS IMPORTANT, you'll find Iridite prevents underfilm corrosion and soap formation.

OR, FOR BRIGHT, DECORATIVE FINISHES—

investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!

Write for literature and send us samples for test processing. See "Plating Supplies" in your classified telephone directory or write direct.

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Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Brighteners.
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There's still a NICKEL SHORTAGE! — BUT

Now you can have bright, attractive, wear-resistant chromium plated finishes *WITHOUT THE USE OF NICKEL*

LUSTER-ON® ZINCROME® PROCESS*

provides *excellent corrosion resistance* — up to 100 hours standard salt spray

LUSTER-ON ZINCROME PROCESS

provides *good wear resistance* — the hardness of chrome plate needed for tools, bumpers, etc.

LUSTER-ON ZINCROME PROCESS

provides *accepted brilliant finish* — for outside wear exposure required for automotive trim, etc.

LUSTER-ON ZINCROME PROCESS

provides *economical operation* — high, rugged quality at lowest possible operating cost

LUSTER-ON ZINCROME PROCESS

provides a *precisely controlled "package" process* — 10 easy-to-follow, easy-to-use steps

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FOR CHROMIUM PLATED FINISHES WITHOUT THE USE OF NICKEL

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*Patent applied for

THE *Chemical* CORPORATION
58 WALTHAM AVENUE SPRINGFIELD 9, MASS.

new development in the field of tumbling compounds and it brings to the tumbling room all the advantages of modern color identification.

This new feature means:

Easy, more positive identification.

Easy, more positive instruction.

Easy, more positive supervision.

Avoidance of wrong use and costly errors.

Saving of time for both supervisors and operators.

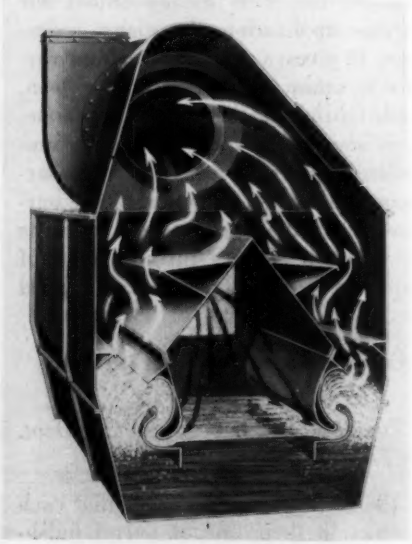
New Type Dust Collector

American Air Filter Co., Inc., Dept. MF, Louisville, Ky.

The above firm has announced its Design 4, Type N Roto-Clone dust collector, an improved hydro-static precipitator that separates the dust from the air by means of an S-shaped water curtain. This unusual and distinctive water curtain has proved highly effective in collecting most types of process dust.

It is available in three basic arrangements which are identical in operating principle but differ in hopper design and means of sludge removal. The three arrangements provide manual cleanout, continuous drain and sludge ejection by flight conveyors.

Among the improved features are:



non-plugging water entrainment separators; heavier sludge ejector mechanism; wider range of sizes and capacities; and sectional construction to permit field conversion from one arrangement to another. The Type N collector is now made in sizes for capacities from 1,000 c.f.m. to 48,000 c.f.m.

Unitized Vapor Degreaser

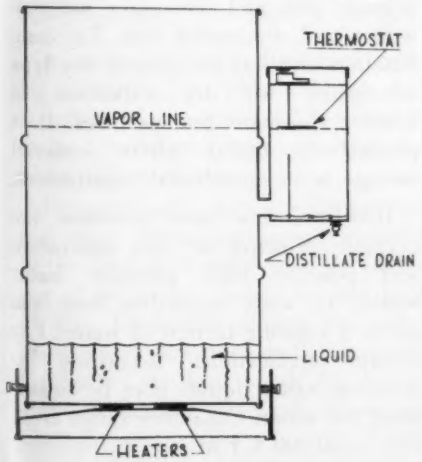
Baron Industries, Dept. MF, 241 West Ave. 26, Los Angeles 31, Cal.

A revolutionary new unitized method of vapor degreasing for cleaning industrial parts and materials has recently been introduced.

Combining the very latest methods of vapor degreasing with the most modern and scientifically perfected equipment, the new Baronet degreaser is both practical and economical in industrial cleaning operations.

Rapid parts cleaning is accomplished automatically in pure, non-inflamable trichlorethylene vapors. Oily and greasy parts are simply lowered into the vapor zone of this barrel-type degreasing unit and deep and thorough cleaning is effected in less than a minute.

The degreaser requires only five gallons of cleaning solvent for effective operation. Reclaiming of the dirty solvent for re-use is one of the foremost features of the new equipment. This process is accomplished automatically by an air-cooled condenser



NEW FEDERATED ZINC ANODES

. . . Better Than Ball Anodes

. . . No Flash . . . No Gate . . . No Voids

Make your plating job easier by using Federated Zinc Anodes, the smooth zinc anodes that won't catch or stick when you drop them into the container.

These anodes are round on top, flat on the bottom . . . scientifically designed and cast in an open mold to give you a smooth-finish anode without voids or inclusions.

The material used for Federated Zinc Anodes . . . special high-grade zinc and no scrap . . . and Federated's known superiority in production combine to make these anodes the best on the market.

To order or to obtain further information on Federated Zinc Anodes or on any other anodes for the plating industry, call or write any one of Federated's 24 sales offices across the country. There is one near you.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY
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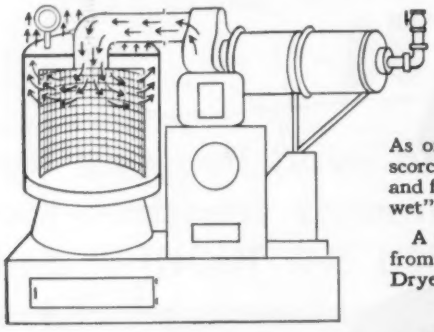
EVER BLOW INTO AN ASH TRAY?

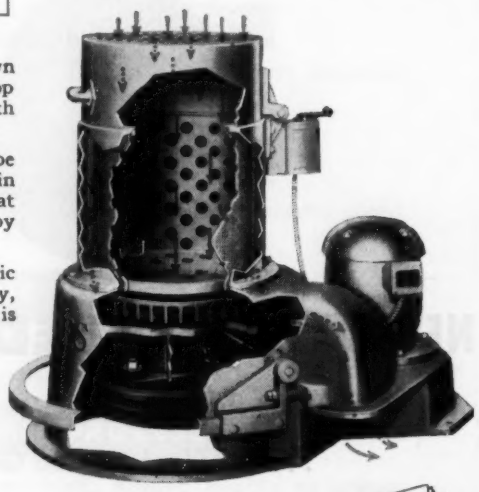


If you did, you saw a practical demonstration of the principle of air deflection. In old type dryers, air *blown* in from the top is deflected by the top layer of parts. As one user put it, "the top layer gets scorched, the next layer is nice and dry, and from there on down the parts are still wet".

A powerful suction fan *draws* the air from the bottom of the modern Nobles Dryer. Fresh air rushes in from the top to fill the vacuum and is drawn through the entire contents from top to bottom where it is expelled with the water.

Steam or electric heaters may be mounted compactly in the cover in contrast with space consuming, heat wasting, separate units connected by pipe.

An internal expanding, hydraulic brake stops the machine smoothly, and quickly. The "brake pedal" is a ring extending around the entire working area so that the machine can be stopped instantly from any working position. In the interest of faster drying and lower costs write today!



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which also controls the vapor height. Clean, pure vapors are generated by electric elements mounted in the base of the assembly, and a thermostatic control insures operational safety and provides maximum economy.

The new degreaser is a standard 50 gallon barrel-type unit with a wide working area 23″ in diameter and a vapor depth of 18″. It is complete with a 2 KW electric heating unit, condensing chamber, thermostat, 15-ft. plug-in cord and unit cover.

Hydraulic Honing Machine

The Hydro-Hone Manufacturing Co., Dept. MF, 6829 Rita Ave., Huntington Park, Cal.

The above firm has recently introduced to industry a new hydraulic honing machine. The new unit offers a greatly improved process for the liquid-abrasive cleaning and polishing of all metal parts.

Incorporating a number of revolutionary design changes, company engineers have made it possible to increase finish appearance and accuracy, speed production, and greatly decrease upkeep costs Among the many exclusive new features is the automatic drain which promises a 300% faster changeover from one abrasive to another. Operators are assured exceptional blast chamber visibility through an increase in illumination to 1,200 watt brilliance —and a new blower system that completely changes interior air every three seconds.

The costly, time-consuming pump packing contamination usually present with abrasive blast equipment has been overcome by a special pump that eliminates the packings entirely and also allows the abrasive carrying fluid to by-pass all bearings.

Keeping the machine operator at top efficiency through lessened fatigue has been accomplished by newly designed, comfortable foot controls — by the streamlined front panel design permitting sit-down operation, and by the wide, clear vision inspection port placed at a natural vision angle. Employing the new color-dynamics principle, the machine is painted a vista green that lessens eye fatigue and contributes to overall plant appearance. The machine has been designed to occupy the minimum of factory space.

Another unique and important feature is an unconditional guarantee covering a one-year warranty on both parts and workmanship. This is an important step forward for the abrasive finishing industry. Company engineers will install and instruct factory personnel at the time of delivery and periodic service calls will be made after installation without cost or obligation.

Manufacturers' Literature

Folder on Dust & Fume Eliminators

Schmieg Industries. Inc., Dept. MF, P. O. Box 4701, Detroit 34. Mich.

Two new Centri-Merge vertical rotor wet type dust and fume eliminators are described in Bulletin VU-8-53, issued by the manufacturer. One is for wet collection and elimination only, while the other is a combination primary dry and secondary wet collection and elimination unit. The combination unit has an integral dry type pre-cleaner for dry collection of heavier and most fine particles. It is particularly useful where material salvage is an operational requirement.

Both the new units combine the cyclonic principle of dust separation and positive high pressure water action, to wash impurities from the air in a rotating torrent of water. For certain applications, according to Schmieg, other liquids may be substituted for water. Capacities range from 500 to 50,000 C.F.M.

Clad Metal Inventions

Knapp Mills, Inc., Dept. MF, 23-15 Borden Ave., Long Island City, N. Y.

A new pamphlet describing nine new developments has been announced by the above company, America's largest producer of lead clad steel, and lead clad copper.

Metal Processing Chemicals

Klem Chemicals, Inc., Dept. MF, 14401 Lanson Ave., Dearborn, Mich.

The above manufacturer announces a new catalog for use by metal processors and finishers to aid in selecting correct chemicals for various operations. The catalog lists 33 standard Klem products and contains a comprehensive application chart for surface preparation of ferrous and non-ferrous metals.

The company's laboratory facilities for compounding special chemicals for unusual conditions have also been described in the catalog.

Acid and Caustic Resistant Work Clothes

Worklon, Inc., Dept. MF, 253 West 28th St., New York, N. Y.

The catalog features a complete line of men's work cloths in both miracle fabrics. . . . Du Pont's Orlon and Union Garbide's Dynel. Both fabrics are acid and caustic resistant and have tremendous economy appeal for chemists, laboratory and factory technicians, as well as those engaged in industrial fields where acid conditions make work clothes replacements frequent and costly For "Super Clean" areas a lint-free Orlon is available.

Plating Anodes Catalog

Federated Metals Div., American Smelting and Refining Co. Dept. MF, 120 Broadway, New York 5, N. Y.

A new eight-page, illustrated catalog, Bulletin No. 141, provides full information on copper, lead, zinc, tin, tin-lead, cadmium, cadmium oxide and brass plating anodes.

Data on sizes, shapes, compositions and other characteristics are included in the catalog to make easy the ordering of the proper anode for any kind of job. Prominent among the many anode types described is the exclusive Conducta-Core lead anode for heavy-duty decorative or hard chromium plating.

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Sander Discs by CARBORUNDUM

Packaged to save you time and money *on the job* and in the *storeroom!*

Fast-cutting, long-life CARBORUNDUM Brand Sander Discs now bring you extra savings—give you *more for your dollar!* Here are the reasons:

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No straps to damage disc edges—or to weaken the fibre by pressure-forcing grain into backing.

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Maintains proper moisture content in each disc to give you top performance in use. Keeps out excess humidity in transit and storage.

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CALL YOUR CARBORUNDUM DISTRIBUTOR or salesman today. He offers a complete line of sander discs for every sanding job. He'll gladly help you select the right combination of discs and sander pads to save time and money on the production line...and in handling and storage. You'll find him listed in the yellow pages under "Abrasives" or "Grinding Wheels." Or, if you prefer, write to The Carborundum Company, Dept. MF 82-325, Niagara Falls, N. Y.

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82-325A

New Pickling Inhibitor Described in Folder

E. F. Houghton & Co., Dept. MF, 303 W. Lehigh Ave., Philadelphia 33, Pa.

A 4-page folder is now available on Acitrol 3129, latest development in a line of pickling inhibitors produced by the above company for the past 30 years. The bulletin outlines the functions and advantages of the inhibitor in terms of what the product can do to cut steel production costs and improve quality. The new product, a liquid which is readily mixed with the acid solution, is described as having excellent resistance to breakdown at boiling point, and is said to be equally efficient in HCl. H_2SO_4 and H_3PO_4.

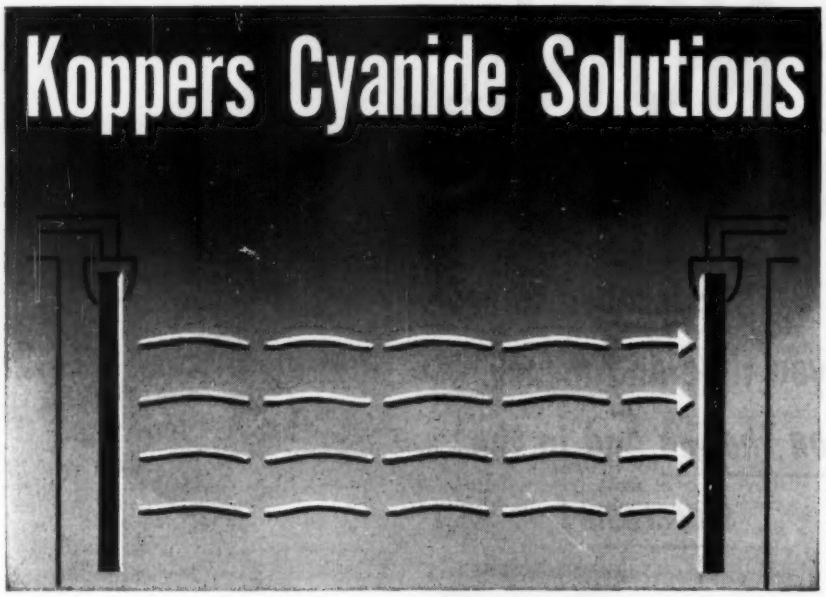
Zinc Phosphate Coatings for Steel

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

The manufacturers have announced the publication of a new booklet "How to Apply Better Zinc Phosphate Coatings to Steel in Preparation for Painting," which describes the recently developed CrysCoat HC Process.

This 12-page booklet gives a concise, clear-cut explanation of the problems involved in securing lasting paint adhesion on steel, and in protecting

Koppers Cyanide Solutions



Make Electroplating Easier . . . Safer . . . Faster

● Koppers is pleased to offer these three convenient cyanide solutions to the electroplating field. Their availability in solution form obviates the troublesome, dangerous, and time-consuming task of handling and dissolving cyanide granules.

Potassium Cyanide, 35-40%—widely employed in electroplating where copper is used as a base coat for chromium plating. Forms soluble complexes with copper, silver, gold, cadmium, zinc, and other metals of the general form $K_2M(CN)_3$ or $K_2M(CN)_4$. Extremely low sulphur content but with high purity.

Sodium Cyanide, 26-30%—a complexing agent manufactured from high purity hydrogen cyanide, reducing to a minimum the amount of contaminating organic chemicals and inorganic salts. Extremely low sulphur content.

Barium Cyanide, 30%—suggested as a cyanide plating bath additive, particularly in cadmium plating to remove the troublesome effect of carbonates and sulfates in the bath. Combines the qualities of high purity and low sulphur content.

Potassium Cyanide is available in 55-gallon drums or tank truck quantities. Sodium Cyanide is available in tank truck and tank car quantities. Barium Cyanide is offered in 55-gallon drums. The lower price structure and safe, easy-to-use liquid form of these cyanides, make them especially desirable to the electroplater. For further details, write to:

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Koppers Chemicals

KOPPERS COMPANY, INC.

Chemical Division, Dept. MF-103, Pittsburgh 19, Pennsylvania

painted surfaces from electrochemical corrosion. It describes the action of the material in coating steel surfaces with a heavy zinc phosphate film which exceeds the requirements of U. S. Government Specifications JAN-C-490, Grade I; 57-0-2C, Type 2, Class C; and PA-PD-191 (Rev. 1). Photographs showing the results of standard salt spray tests on treated and untreated steel panels, and drawings illustrating both corrosion and the anti-corrosive action are among the many illustrations.

Ultrasonic Cleaning

Detrex Corporation, Dept. MF, Detroit 32, Mich.

The above producer of industrial metal-cleaning equipment and chemicals has announced the publication of a special technical folder on its new Soniclean process, the application of ultrasonic energy for the cleaning of metal parts.

Illustrated by appropriate graphs and diagrams, the folder describes in considerable detail the principles and methods used in the new process.

The company has carried its development work in the ultrasonic field to a point where it now can provide crossrod conveyorized or monorail units that provide more than 120 work carriers per hour. These trays vary in size up to 10″ x 10″ and clean work up to 3″ in height. Radio frequency generators up to 5 kw and larger are incorporated into the units, depending upon the sound intensity and the time cycle required to obtain the desired cleaning result.

Flexible Plastic Coating

Stonhard Co., Dept. MF, 1306 Spring Garden St., Philadelphia 23, Pa.

The above firm has issued a small folder on Stonhard Stoncote, which is a protective coating used in maintenance areas where rust and corrosion are special problems.

Industrial Filtration

Industrial Filtration Co., Dept. MF, Lebanon, Ind.

A new general 8-page bulletin is now available on Delpark industrial filters. Major features are complete dimensions and capacities of the various filters available for industrial

applications, featuring continuous, full-flow, self-cleaning, fully automatic disposable belt-type filtration. Applications include filtration of paint spray booth water.

Insulating Joints for Piping

Barco Mfg. Co., Dept. MF, Barrington, Ill.

A new bulletin describing insulating joints for piping lines to electrolytic plating, cleaning, and anodizing tanks used by metal working industries has just been released by the manufacturer.

This is a unique development pioneered by Barco for providing an electrical insulating barrier in a pipe without interfering with its capacity or efficiency for conveying steam, water, chemicals, or gases. Besides promoting safety and preventing wasteful leakage of current, the joints are often useful in preventing pitting or corrosion due to electrolysis.

Acid & Alkali Resisting Coatings

Electro Chemical Engineering & Mfg. Co., Dept. MF, 750 Broad St., Emmaus, Pa.

New literature covering their Duro-Kote and Duro-Kote No. 57 acid-proof coatings, has been announced by the above manufacturer. These materials give the highest type of vinyl and butadiene styrene acid-proof resin protection against acids, alkalies, and many solvent actions respectively.

Duro-Kote and Duro-Kote No. 57 are planned primarily as acid-proof and alkali-proof maintenance paints useful in metal finishing plants.

Folder Describes Uses, Benefits of Metallizing

Protective Coatings Division of Metalweld, Inc., Dept. MF, Scotts Lane & Abbottsford Ave., Philadelphia, Pa.

A new, four-page 2-color, illustrated folder on the application of, uses for and benefits to be obtained with metallizing has recently been published. Included is a section entitled "What The Metallizing Process Can Do For You" that contains photos, drawings and descriptive copy on the many applications throughout industry for metallizing. The folder also contains a description of the process itself as well as important data on a new spraying

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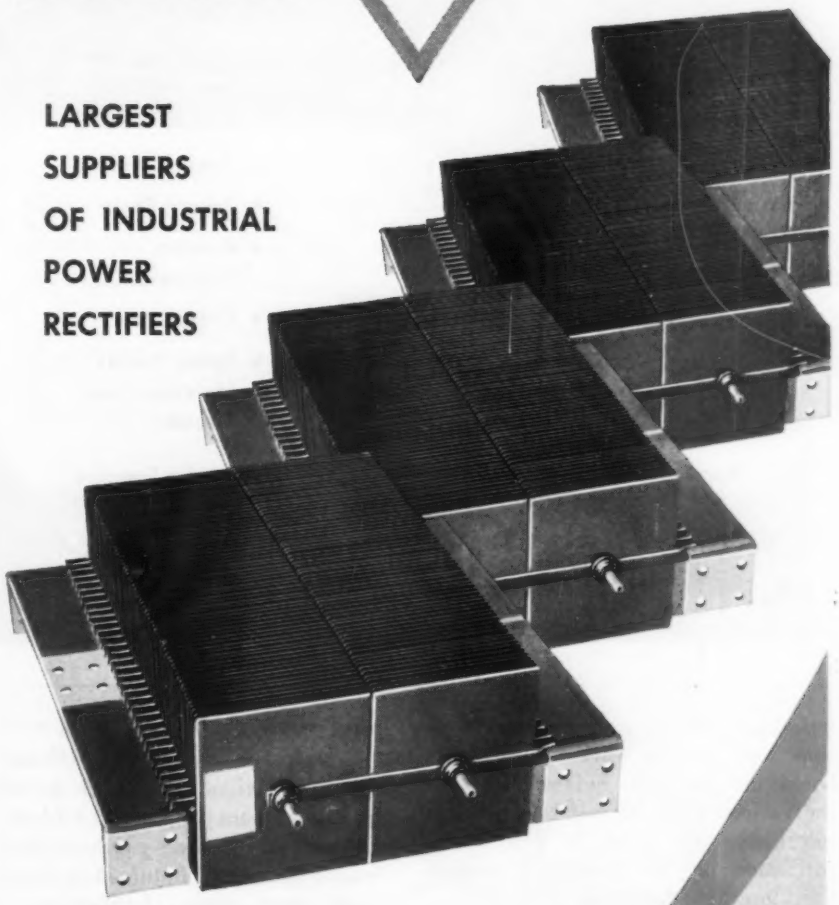

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Complete, Modern Facilities Assure You The Utmost in Quality and Service on

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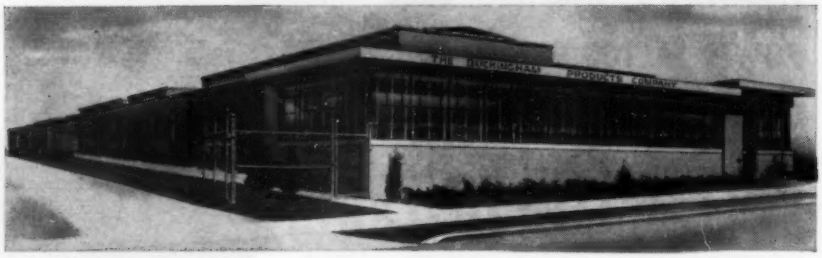

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technique which saves considerable time and permits work on jobs that could not be done before. Uses for the various types of metals applied in metallizing are given as well as information on the company's modern shop and field facilities.

"Soft" Metal Deburring

Modern Industrial Engineering Co., Dept. MF, 14230 Birwood Ave., Detroit 4, Mich.

Two standard Maizo Blast machines for the production deburring of a variety of "soft" metal parts are described in Bulletin No. 103-57. Since 60 to 80 p.s.i. air pressure is needed for the blasting operation, normal plant air is all that is needed.

Descriptions and specifications of both production models are included in the bulletin. Model MA-24 is a continuous operating machine with a ferris-wheel type fixture for holding small parts made of aluminum or other soft metals. It's normal production rate is 192 to 288 pieces per hour and the simplified loading fixtures enable one operator to handle two machines.

Larger parts that can be deburred in the continuous machine are handled in Model MA-1, a stationary unit in which parts rotate on a fixed axis in a fixture. The guns are adjustable as to blasting angle and the machine can be supplied with 2, 4 or 6 guns.

Dust Control in Metal Working

American Wheelabrator & Equipment Corp., Dept. MF, 1179 S. Byrkit St., Mishawaka, Ind.

How dust can be controlled in metalworking industries is discussed in bulletin 392 published by the manufacturer. Particular attention in the bulletin is given to the use of high-efficiency cloth-tube-type dust collectors in the ventilation of grinding and annealing operations, sprue mills, and blast cleaning equipment. A section is also devoted to the role of cloth filtration in such hot operations as the collection of foundry cupola fume.

The importance of product recovery is pointed out. One case cited explains how a plant completely amortized its collector by salvaging usable metal dust and continued to enjoy the extra profit thereafter.

Copies of this illustrated folder may be obtained free from the manufacturer.

Heating Coils

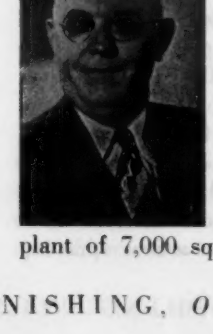
Platecoil Div., Tranter Mfg., Inc., Dept. MF, 735 East Hazel St., Lansing 4, Mich.

A special Industry Report 12 on the use of Platecoil units in the automotive industry has been compiled by the above division.

The illustrated survey describes three installations in automobile manufacturing and supplier plants where the unit has resulted in more efficient heat transfer with less down time. Now used by many firms as a replacement for pipe coil, it is essentially two sheets of metal embossed to form channels for the passage of the heating or cooling liquid, and joined together by resistance welding.

News from California

By Fred A. Herr



Tool & Jig Plating Co. of Los Angeles on September 1st broke ground for a new plating plant in Whittier, Calif. *Ernest Fest*, president, reported to METAL FINISHING that the new plant of 7,000 square feet floor area

will be housed in a building costing $53,000 outfitted with some $45,000 in equipment.

Most of the tank and auxiliary facilities will be transferred from the company's present plant at 1236 Rio Vista Ave., Los Angeles. Eight hundred gallons of new capacity will be added to the holdover equipment, which consists of 680 gallons of copper, 720 of nickel, 450 chromium and 450 hard chrome. Additions will be in the form of 300 gallons of cadmium and 500 gallons of zinc.

The firm was organized in 1943. Fest is president, *Dexter Halldin*, vice-president, and *Barker Woodward*, secretary-treasurer. The company handles considerable volumes of hard chromium aircraft work and plating on stoves and other job contracts.

A new Southern California finishing firm went into operation in midsummer under the name of The Chemplate Co. Office and production facilities have been established at 2671 East 26th St., Los Angeles. The new plant of 4,000 square feet floor area is equipped for plating of customer parts with the Chemplate process, a technique developed by the operators of the new firm with which corrosion resistant metals can be deposited on the exterior and interior surfaces of ferrous and cuprous alloys.

Associated in the operation of the company are *Bert J. Sherwood*, formerly supervisor of the Enthone Products Div. of the L. H. Butcher Co.; *Doyle Lindley*, and *Edward Zorn*.

Chrome Nickel Plating Co. is now housed in an enlarged plant of 5,000 square feet floor area and costing some $35,000 at 3230 Tweedy Blvd., South Gate, Calif. A total of 2600 gallons of solution facilities have been installed, according to president *John Hamer*, including 1,000 gallons of copper and 800 gallons each of nickel and chromium. The bulk of the firm's work consists of repairing and replating automobile bumpers.

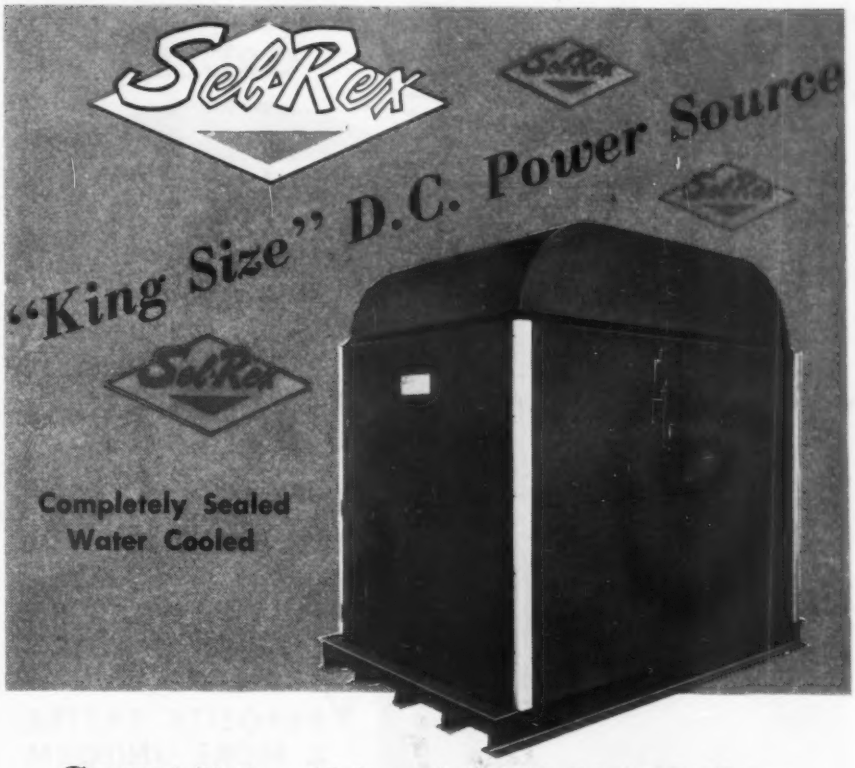
In order to provide space for the addition of cadmium and zinc plating facilities, *Al Richards*, owner of Quality Metal Finishing Co., and Richards Rack Co., 2837 Imperial Highway, Lynwood, Calif., reports he has disposed of his rack manufacturing facilities, including designs, machinery and records, to California Rack Co., which is operated at 4952 Firestone Blvd., South Gate, Calif., by *Howard Woodward*.

Richards had been in the plating rack design and production business for a number of years. A year and a half ago he went into anodizing and dyeing under the name of Quality Metal Finishing Co. at the same address in Lynwood. His decision to expand his finishing operations by the addition of zinc and cadmium prompted the disposal of the rack making facilities.

California Rack has experienced a phenomenal growth since it was organized by Woodward five years ago following his resignation from the Sundmark Supply Co. sales staff. The firm designs and manufactures plating racks and fixtures for all purposes required in the finishing industry.

Harold E. Pust has established the Pust Polishing & Honing Co. at 825 Date St., Alhambra, Calif. The plant has been equipped for plating cadmium, chromium, nickel, zinc, tin, copper, lead, silver, gold, brass and alloy work; also anodizing, magnesium treatments, chemical blackening and lacquering, pickling, deburring, tumbling, burnishing, degreasing, polishing and buffing.

The Barber-Webb Co. of Los Angeles handled the prime contract on two processing tanks recently installed for Lockheed Aircraft Corporation, Burbank, Calif., which are said to be



SEL-REX builds the world's largest single cubicle Selenium Rectifiers — up to 50,000 amperes — completely sealed and water cooled for absolute protection against dust, dirt and corrosion. Large single cubicle units, that will fill any D.C. power requirement, are another engineering accomplishment of the same company which originally developed completely protected rectifiers designed to withstand highly corrosive atmosphere.

There is a Sel-Rex Selenium Rectifier for every plating purpose, from 25 to 50,000 amperes. Regardless of size or type, all of them incorporate the features that make Sel-Rex the foremost name in D.C. power — top efficiency, long life and low maintenance costs, even under the most rugged plating conditions.

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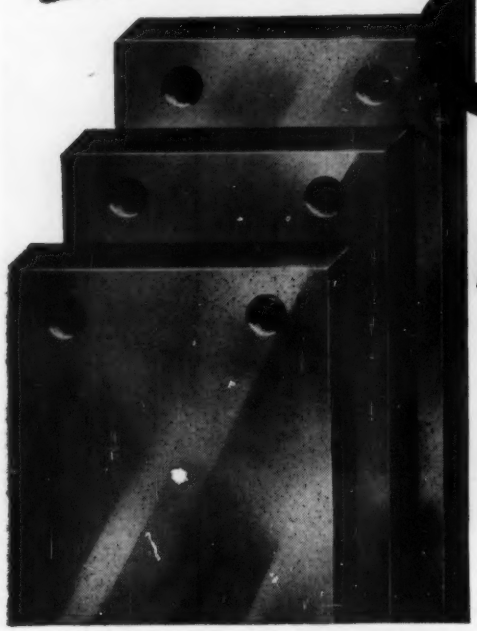

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among the largest Koroseal tanks yet produced.

The tanks are used in the Lockheed metal finishing division for aluminum and alloy parts to prepare the surfaces for painting.

The tanks are 50 feet long, 4 feet wide and 11 feet deep. The Koroseal lining in one tank is for a nitric phosphoric acid solution at room temperature. The other tank is used for a conversion coating solution at 75 to 95°F.

California Plating Works, the oldest established metal finishing concern in the Pacific Northwest, recently moved to a new and larger plant at Northwest Flanders and 16th Sts., Portland, Ore. The shop is equipped to handle a wide variety of plating, from silver finishing of small items to hard chromium plating of huge five-ton gates for the McNary Dam. *John H. Day* is president of the firm which was established in 1907 by *Ben Dillon* and *Bert Hawes* as a silver plating operation.

Dan Sutton of the Cleveland Products Co., Cleveland, Ohio, manufacturers of immersion heaters, spent a week and a half on a business trip in California in September. He divided his time largely between Los Angeles and San Francisco, conferring with West Coast distributors of the Cleveland Products line — *Jack Raskin* of L. H. Butcher Co., *Jack Beall* of Crown Chemical & Engineering Co., *Clarence Thornton* of L'Hommedieu He attended the September 9 meeting of Los Angeles A.E.S. Branch as the guest of *Larry O'Neil* of L'Hommedieu.

Gene Rynkofs of the Liberty Plating Co., Los Angeles, returned early in September from a vacation trip to Mississippi, Arkansas and several other southern states, just in time to take over at Liberty Plating to permit brother *Stanley* to take-off with his family on a visit to Mrs. Stan's folks in North Dakota.

Coincident with the removal of its Pacific regional offices and warehouse from 225 Bush St., to 460 Ninth St., San Francisco, American Air Filter Co. of Louisville, Ky., announced the appointment of *Richard H. Nelson* as Pacific regional manager. Nelson, a vice-president of the company, succeeded *C. A. Pickett*, who has been transferred to Chicago. The changes were effective September 1.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

1954 Convention

The *New York Branch* will be the host branch at the forty-first annual convention of the *American Electroplaters' Society*, to be held from July 12 to July 15, 1954 at the Statler Hotel. It has been seventeen years since a Convention was held in New York, and those members who remember the Silver Jubilee Convention in 1937 will have some idea of what is being planned.

The chairman of the convention committee is *George Schore*. The names of the committee members will be published in future issues of this publication. However, the chairman would like to focus attention on a special committee which has been formed under *Moe Ranno*, a partner at *Imperial Plating*, known as the *Visitors' Entertainment Committee*. The function of this group will be to procure tickets to any of the shows, ball games and other entertainment offered in

New York. A fishing party can also be arranged, if desired. Moe has promised to "get them anything they want." A future publicity report will cover the operation of the committee more fully.

So that you can be brought up to date on New York. we are outlining some of the outstanding features of the city.

First let us say that to those of you who have never been to New York, your first view of the Island of Manhattan, one of the five boroughs comprising the City, will be unbelieveably strange and beautiful. Our skyscrapers, 56 in all, are among the marvels of the world, and each one is a design of beauty and distinction.

New York is perhaps the most cosmopolitan city on earth — 40 languages and dialects spoken, and 20-odd foreign language newspapers published. Visitors from abroad may obtain, instantly, interpreters in every one of the civilized languages.

Our city is the nation's educational center, with 13 colleges and universities, 8 schools of medicine, 2 of law, 5 technical institutions, and 4 schools of theology.

If your interests lie on the cultural side, there are many museums, private and semi-private galleys you may visit, also botanical gardens, theaters and concert halls. New York is also the home of the Metropolitan Opera Co.

Whatever your favorite sport, New York can accomodate you. During the baseball season there is always a major league game being played, as the City has 3 major league teams.

The newest attraction New York City has to offer is the United Nations, where you may watch world history in the making. Tickets may be obtained for attending sessions, and daily tours are conducted through the buildings.

We could go on and on, telling of what there is to see and do in New York, but instead we'll just say come and see for yourself in '54.

Indianapolis Branch

The first meeting of the 1953-54 year was attended by 33 members and guests who enjoyed a steak dinner at the Fox Steak House on September 2nd. Guests included *Ezra Blount* of Cincinnati, *Tom O'Brien* of Chicago and *Marvin Steuernagel* of Milwaukee.

The meeting was opened by *Abraham Max*, president, by asking each person present to introduce himself and state his business. This was followed by the secretary's report, which was accepted. The treasurer reported on the April dinner-dance and said there was a balance of $292.01 after all bills were paid. This report was voted to be accepted in a motion by *Claude Weekly* and seconded by *Elmer Lundberg*.

National Convention reports were given by *John Holland* and *John Hood*.

The following were elected: *James D. Powell*, 258 S. Sheridan St., Indianapolis and *Edward Smith*, R. No. 2, Elwood, Ind. This motion was made by *Ed Bruck* and seconded by *Tom Evans*.

Future plans were discussed concerning program and annual dinner-dance. It was decided to eliminate the educational session at the next regular affair but to have the dinner and dance. Mr. Blount was present especially to talk about a regional meeting of the branches of Cincinnati, Louisville, Dayton, Columbus and Indianapolis. This idea was widely discussed by many. Harry Smith made a motion that the Indianapolis Branch support the Ohio Valley Regional convention. This was seconded by *Al Kriese* and passed. This regional will no doubt attract very fine speakers for the educational session.

The Branch meeting for November will be held at the Hotel Antlers in Indianapolis.

The speaker of the evening was *Charles O. Harkin* of *Metal Coatings & Mfg. Co.* Mr. Harkin, a former

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TECHNICAL GRADE—FLAKE

Only a few years ago we were new comers to the Chromic Acid business. Since then we've shipped quite a few million pounds . . . and made a lot of good friends, too.

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school teacher, quoted many passages from letters of famous Indiana pioneers and historians. He cited how many cities obtained their names and how some various streets got theirs. The group was very much interested.

The meeting adjourned at 9:50 P.M.

Los Angeles Branch

Los Angeles Branch of the *American Electro-Platers' Society* inaugurated its fall series of technical sessions on the night of September 9th with a discussion of "Corrosion In Action" by *J. B. Morray* of the development and research division of International Nickel Co., Inc., of Southern California.

Mr. Morray's talk was largely in the form of explanatory comment for a film on corrosion which was presented after the close of the business session in Rodger Young Auditorium.

The speaker presented a graphic explanation of corrosion and how to control it. With film and commentary he described how corrosion acts to cause an annual loss of more than six billion dollars and how this damage can be avoided or controlled by various means. The film Morray declared, was designed essentially for technical, educational and industrial groups, but its treatment of the subject was such that it could be readily understood by non-technical audiences. A discussion period followed the showing of the film.

The branch's opening fall session attracted an attendance of 75 members and guests. First vice-president *Stuart Krentel* of the *A. J. Lynch Co.*, presided in behalf of president *John Millhorn* of the Mefford Chemical Co., who was reported to be vacationing somewhere up in the Wasatch Mountains in the Salt Lake country of Utah.

William Nairne reported for a committee named to recommend a site for the 1954 annual educational sessions. He announced that the board of managers had voted to recommend March 20, 1954, as the date, the Ambassador Hotel, Los Angeles, as the site. The recommendation was approved by the membership. Nairne reported that, if space permits, an effort will be made to hold a products exposition in conjunction with the 1954 session.

Discussions started by branch leaders earlier this year to develop some effective method for producing a con-

tinuous influx of new members materialized to the point where a concrete New Members Plan was adopted at the September 9th meeting.

Doubling present membership by having each member bring in one new member is the keystone of the plan. Approved was a recommendation of the executive board that a contest be sponsored in which a first prize of a $50 merchandise certificate be presented to the member who sponsors the largest number of accepted applications between September 9, 1953, and March 10, 1954. An award of a $25 certificate will be made to the runner-up.

The sponsoring member as well as the applicant must be present in person, or by suitable proxy, at the meeting when the application is submitted. Application blanks properly filled out must be presented to the first vice-president, accompanied by the initiation fee and the required amount of dues for the balance of the fiscal year. Officers of the branch are not eligible to participate in the contest. The board of governors will act as judges in determining award winners.

Stuart Krentel, in his capacity as first vice-president, is general director of the membership drive.

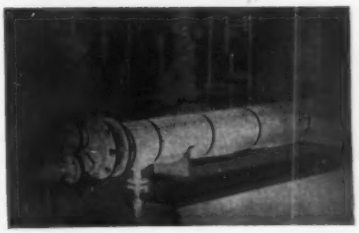
The Millhorn Maulers opposed the Davis Dipsydoodles in a baseball game at the annual picnic of Los Angeles Branch of the *American Electroplaters' Society* on August 22. When the smoke and dust of the battle had cleared, as the evening shadows settled over Municipal Park in South Gate, the Dipsydoodles looked as though they had been rent asunder by a hydrogen bomb.

The Dipsydoodles, a team composed of plating shop operators and employees, and managed by *Warren Davis* of Fleetline Plating Co., were slaughtered by the Millhorn Maulers, an aggregation of supply house representatives managed by *John Millhorn* of the Mefford Chemical Co., and president of Los Angeles A.E.S. Branch.

METAL FINISHING'S official scorekeeper was handicapped by the lack of an adding machine, but arrived at an approximate final score of 27 to 13 in favor of the Maulers. The Suppliers were wondrously elated at the result as it represented their first vic-

Here's How You Can Solve Your Acid Heating Problem *in a hurry!*

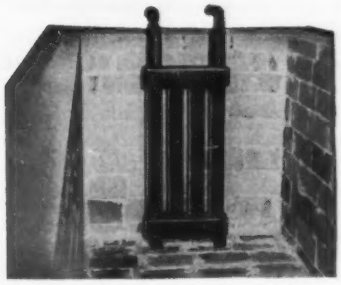
Investigate the many outstanding performance features of HEIL Impervious Graphite "NOCORDAL"* Units.



Shell and Tube Exchangers with "NOCORDAL" Tubes. Standard sizes for ready selection. Also available with nickel, steel and other alloy tubes.

1. LONGER SERVICE LIFE

"NOCORDAL" is inert to most strong acid solutions. Ideal for iron plating as well as Bright Nickel Baths, Hydrochloric and other strong acids.



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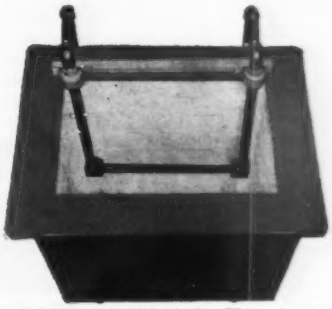

"NOCORDAL" "U" Coils. These immersion units also available in "L" shape and Bayonet style.

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SPEEDIE Compositions in both bar and liquid form are designed to save you on-the-job money. They last longer, give better buff wear.

CLEANING IS NO PROBLEM WITH:
SPEEDIE Tripoli — Stainless Steel — Chrome — Nickel Finish — Grease Stick or Emery Cake Compositions. There's a *SPEEDIE* Compound for heavy cut, light buffing or coloring to a mirror finish.

Write us *on your company letterhead* about objects to be buffed, type of buff used, problem you may be having and how many bars of *SPEEDIE* Compound you will require for an experimental run. Your request will be given immediate attention. Write today.

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tory over the Platers in the past four years.

Don Bedwell, plating supervisor for the Hall-Mark Co. of Los Angeles, who had umpired all previous such battles, was unable to attend this year. Drafted to umpire was *Harold Smallman*, vice-president of the Hanson-Van Winkle-Munning Co. When it was pointed out to Mr. Smallman that the Suppliers had won their first victory with a supply man as umpire, he chuckled and remarked: "Could be you've got something there."

This year's picnic was held on a Saturday as contrasting to all previous ones on Sundays. The platers and their families began arriving at the picnic grounds at 1 p.m. Charcoal pits were available and the air was soon aromatic with roasting steaks, wieners and spareribs as the lunch baskets were brought out for the noon-day snacks.

A series of running races and games for the children was held beginning at 2:30 p.m., with *George Hetz* of the Mefford Chemical Co. having the time of his life supervising the games and deciding which of a dozen or so claimants was entitled to the silver pieces which were awarded to the winners. George, father of four youngsters, had little trouble in settling protests. He simply gave a quarter to every kid who thought he was entitled to one.

James M. Soll, sales engineer of the Federated Metals Div., American Smelting & Refining Co., served as picnic chairman, assisted by *Howard Woodward* of California Rack Company; *Larry O'Neill* of the L'Hommedieu Co.; *Dexter Halldin* of Tool & Jig Plating Co.; *John Millhorn* of Mefford Chemical Co.; and *Warren Davis* of Fleetline Plating Co.

Millhorn summed up the picnic's results as the crowd began to pack up for home around 10 p.m. "Well, I guess everybody had a good time. I know I did."

Cleveland Branch

Although the Convention and Industrial Finishing Exposition of the *American Electroplaters' Society* is nearly two years away, plans already have been launched and developments are under way to make this 1955 metal finishing parade of progress the biggest and best in the Society's 40-year history.

The Executive Board of the AES, taking the first step, announces the completion of a contract with the American Decorating Co., 1849 West 24th Street, Cleveland, O., to produce this exposition, which will be held in Cleveland's mammoth Public Auditorium June 20 through 23, 1955.

American Decorating, a nation-wide organization with 20 years' experience in trade show organization and convention management, has produced and supervised many of the nation's largest industrial exhibitions.

Harold E. Bartlett, of American Decorating, has been appointed Exposition Manager by the AES Executive Board. Responsible for space sales and promotion, he will work directly with the Society's Cleveland Industrial Finishing Exposition Committee.

AES members comprising this committee are: *Leon R. Westbrook*, Consultant; *Howard H Blouch*, Chromium Corporation of America; *Eugene L. Combs*, Diamond Alkali Company; *Herb E. Head*, Briggs Manufacturing Company; *Ralph A. Schaefer*, Clevite-Brush Development Company; and *P. Peter Kovatis*, Executive Secretary of the AES.

Buffalo Branch

At the September meeting, *Richard Lambdon* of the Kanigen Division of General American Transportation Corp. gave a talk on "Immersion Nickel Plating by the Kanigen Process." Between 70 and 80 were present at the meeting.

The next meeting will be on Oct. 2, 1953 and the speaker, *Myron B. Diggin*, will discuss the subject of "Modern Precious Metal Plating."

BUSINESS ITEMS

ALUMINUM — FROM RARE METAL TO ARCHITECTURAL MATERIAL

In the 1880's aluminum sold for $8 a pound, and aluminum casting was considered such a marvel that the cap made for the top of the Washington Memorial was exhibited in Tiffany's window on Fifth Avenue, New York. Today, aluminum plays such an important part in our daily lives that it has even become an ideal architectural metal, thanks to the Aluminum Co. of America, which gave us the Alcoa Building.

This building, which is the fruition of planning, supported by many months of laborious designing and field testing, is intended to serve as a demonstration of the many practical and economical applications of aluminum that are possible in building construction.

The recently completed 410-foot, 30 storied aluminum sheathed skyscraper stands in the heart of Pittsburgh's Golden Triangle. It has no counterpart in the world, being the lightest office building of its size ever built, thus creating a new order of utility, economy and beauty in the twentieth century.

The exterior facing of the building is made up of pressed aluminum panels 6′ wide, 12′ high and ⅛″ in thickness, and, incidentally, entirely maintenance-free. The panels were given an electrochemical finish to build up aluminum's natural oxide coating. A 5% silicon-bearing aluminum alloy liner in the sheet itself, combined with the anodizing process, gives a permanently iridescent gray appearance, without the use of pigment or dye.

Architectural history is being written with installation of first aluminum panel and column cover on Alcoa Building. October, 1951.

The fire-rated back-up wall was literally "sprayed" into place. For this, perlite, a special lightweight concrete, which gives the walls thermal insulation, fire resistance and adequate structural strength to carry wind loads, was used. This material was sprayed from a pneumatic nozzle onto the aluminum lath, after having first masked out window areas. Each one-inch layer was allowed to harden before the next one was applied, until a series of four layers or passes was built up.

Extensive use was also made of aluminum on elevator cabs, interior trim, ceilings, stairs, wiring, piping,

DEPENDABLE

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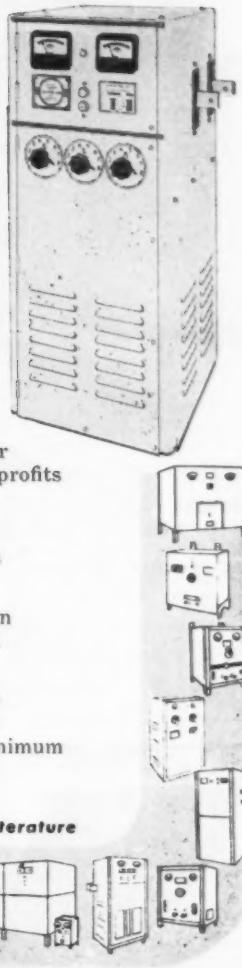

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For increased production, improved quality, fewer rejects, lower labor costs—which translates into higher profits—use Richardson-Allen dependable rectifiers.

The basic R-A Rectifier is widely used where a single voltage or current is needed or where several rectifiers are to be paralleled.

For electroplating chrome or bright nickel a 22-position tap switch is supplied. For electroplating gold or silver, and for anodizing a 36-position tap switch is used.

A special Heat Exchanger unit is available for use in corrosive atmospheres. This R-A development permits operation at elevated ambient temperatures with a minimum temperature rise. Long, uninterrupted, dependable service is assured.

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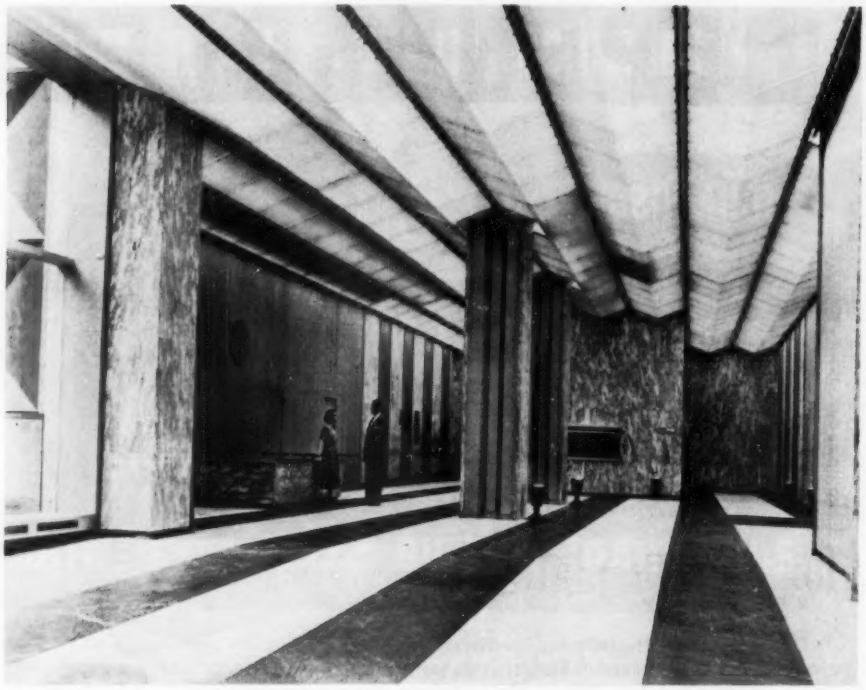


Alcoa Building's main lobby is finished with Norwegian Rose marble columns, satin-finished aluminum extrusions. Ceiling is aluminum mesh with translucent plastic panels.

air-conditioning, windows, lighting fixtures, door frames and hardware. Thus, in almost every phase of building construction, aluminum was used because it has been time-tested and found to be at once practical and economical.

A whole new concept of multistory design and construction has been ushered in. This "showcase" of aluminum construction innovations makes the Alcoa Building one of the most functional office buildings in the world today. Besides demonstrating the basic soundness of aluminum as an architectural material, this skyscraper points up the economy of the light metal, both in initial material costs and ensuing low maintenance costs of its aluminum sheathing in years to come.

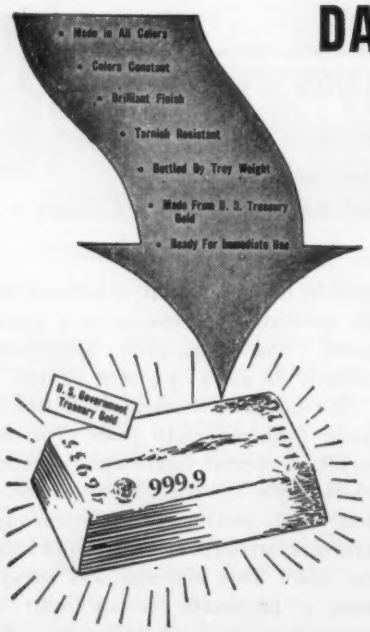
Stevens Opens Warehouse in Ohio

A new service to Ohio customers of *Frederic B. Stevens, Inc.*, has been inaugurated with the opening of a customer service warehouse in Springfield.

Customers in the Ohio area were notified of the contemplated move and, through the use of convenient postage paid return post cards, were given the opportunity to specify items they would like stocked.

Results have clearly indicated the value to the company's Ohio customers of having a local warehouse for certain items in the firm's line.

The warehouse is being operated in conjunction with the Stevens plant in Springfield.



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TANK RHEOSTATS: We are pleased to announce our variable type tank rheostats which are specially designed for precious metal plating.

DAVIS-K SERVICE: Our service today with its newly expanded facilities is fast and efficient. We are fully equipped to reclaim your old gold and rhodium solutions. Phone or write your precious metal problems. We welcome them!

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100% PURE GOLD DKP PRECIOUS METAL SOLUTION

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Topper Changes Name

The *Topper Equipment Co.*, manufacturer of degreasing equipment, has changed its name to *Circo Equipment Co.* This change has been made in order to utilize more efficiently their "Circo" trade name, which was established in 1923.

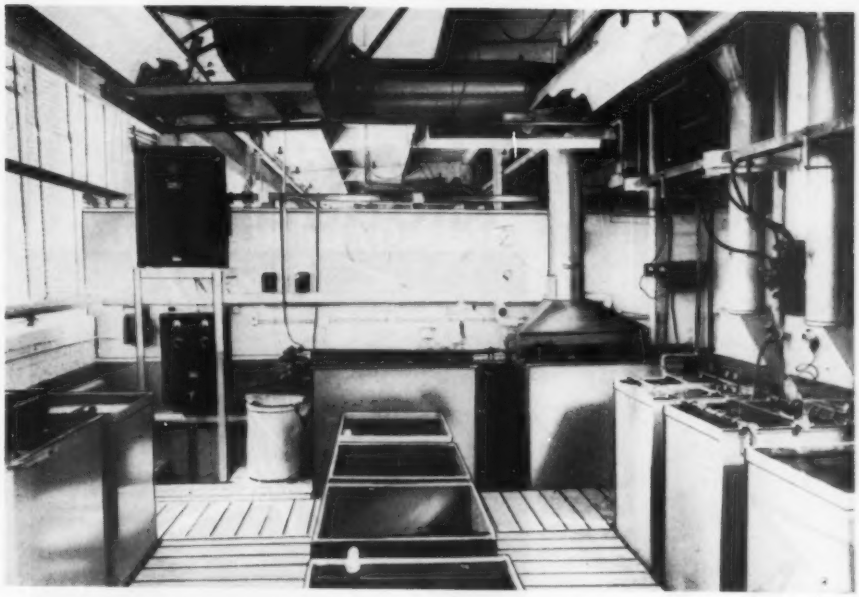
American Silver Co. Appoints Rothman

The appointment of *Arthur M. Rothman* as district sales engineer of *American Silver Company, Inc.*, was announced by *Monroe Sherman*, president.

Mr. Rothman will represent the company in metropolitan New York and the state of Connecticut, working out of the company's main office, located at 36-07 Prince St., Flushing, N. Y., and will call on the manufacturing jewelry trade, as well as the technical-industrial manufacturers in his territory.

He holds a Bachelor of Electrical Engineering degree from the College of the City of New York, and is a member of A.I.E.E. He resides in Jackson Heights, N. Y.

New Laboratory Facilities at J. C. Miller



The *J. C. Miller Co.* of Grand Rapids, Mich., has recently established unique laboratory facilities for product testing and product control. Pictured above is a section of the laboratory containing complete pilot line plating facilities where all newly developed buffing compound formulas and production samples are checked for cleanability and subsequent platability. This section enables plant engineers to evaluate and recommend proper compounds consistent with job requirements and client's cleaning cycle. Product control personnel constantly check production samples to assure uniformity in accord with company's policy of "controlled compounds."

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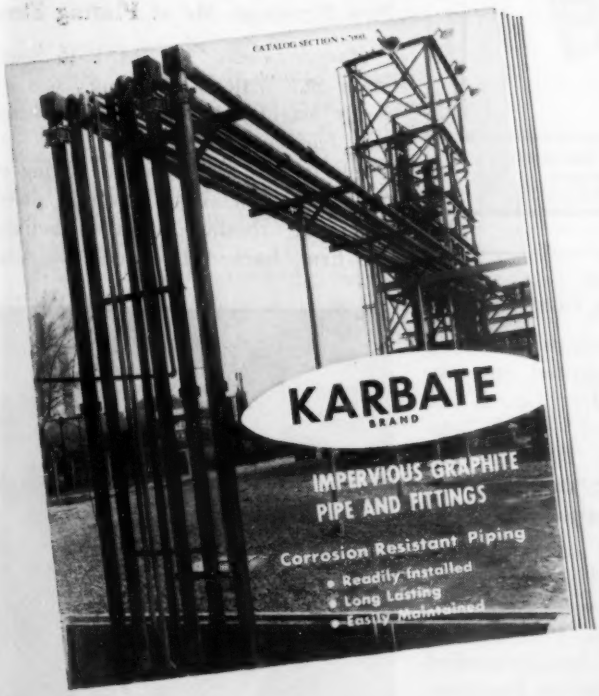

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BRAND
PIPE AND FITTINGS

- Excellent Corrosion Resistance
- Freedom from Metallic Contamination
- High Resistance to Thermal Shock
- Light Weight
- Easily Machined and Fabricated

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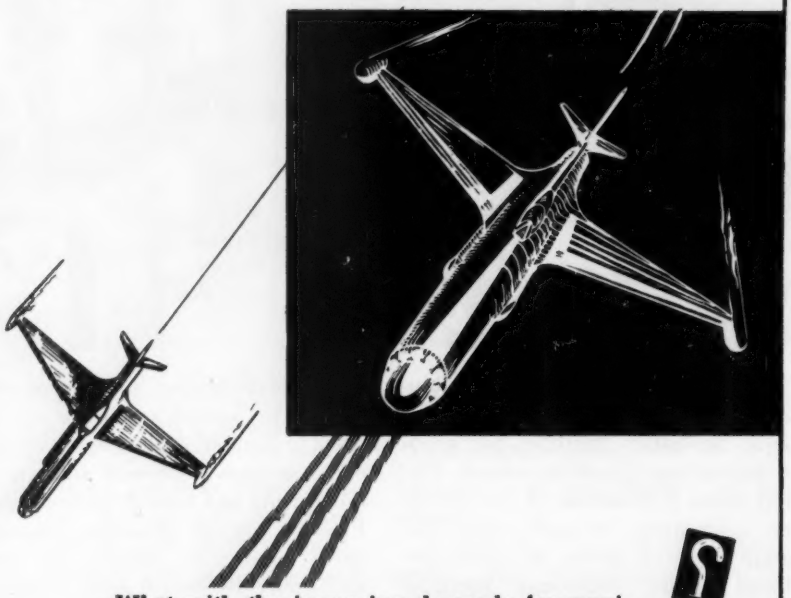

What with the increasing demands for munitions for our National defense, you will want to keep pace, and supply the need. NARACO scientifically designed racks and fixtures are geared to stand the speed of accelerated production and still produce perfect plating.

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Schaffner Opens Research Laboratory

Schaffner Manufacturing Company, Inc., Schaffner Center, Emsworth, Pittsburgh 2, Pa. have just completed their new experimental and research laboratory. This laboratory is the most modern and up-to-date laboratory in the buffing and polishing industry, and will be used exclusively for research and development work for Schaffner buffing and polishing compositions. However, its personnel and facilities are available to help solve metal finishing problems that arise in the metal finishing industry. The industry is invited to feel free to use this laboratory for their buffing and polishing problems.

Stevens Forms Own Company

Eric Stevens, formerly with *Herzog Metal Corp.*, has organized his own concern, the *Stevens Metal Co.*, at 120 Liberty St., New York, N. Y., telephone WOrth 2-7446. The firm specializes in importing cadmium ball anodes, nickel sulphate and nickel chloride.

Diversey Purchases Selcon Engineering

The Diversey Corp. has announced the purchase of the *Selcon Engineering and Chemical Co.* of Chippewa Falls, Wis., manufacturers of automatic solution controls and sanitation chemicals.

In addition to its Chicago plants, Diversey now has factories in Newark, N. J.; South Gate, Cal.; Port Credit, Ont., Canada and Honolulu, Hawaii.

The Selcon purchase will provide additional manufacturing facilities for Diversey's complete line of electronic solution controls plus, added chemical production facilities.

Diversey is a leading producer of industrial chemicals and compounds for the foods, metal working and other industries, institutions and restaurants.

Booth New Carborundum Vice-President

Theodore H. Booth, recently appointed general manager of the Bonded Products and Grain Division of *The Carborundum Co.*, was elected vice-president by the board of directors, according to an announcement by *Clinton F. Robinson*, president of the company.

A native of Buffalo, mechanical engineering graduate of Cornell University, son of the late Charles Arthur Booth, formerly vice-president of Buffalo Forge Company, Mr. Booth was assistant vice-president of Walworth Co. of New York in charge of manufacturing before coming to Carborundum in May 1952, at which time he became director of manufacturing in a staff capacity.

New Precious Metal Plating Firm

Harper-Leader, Inc. of 1046 South Main St., Waterbury, Conn., was recently established by *Perry J. Sloane* and *Isidore Cross*.

Specializing in precision plating of the precious metals such as gold, silver, platinum, rhodium and palladium, the firm, backed by sound practical

Perry J. Sloane

Isidore Cross

experience and flexibility of operation. caters to the many industries using precious metals.

Diversified, modern equipment makes possible the processing of the most complex radar components on the one hand and large-volume findings plated to an exact shade of gold for decorative purposes, on the other. Engineering and decorative applications of the platinum family of metals are a specialty. Laboratory facilities are also available for experimental and development work.

Mr. Sloane has had extensive experience in the precious metal field, having served as technical director of Donham & Craft, Inc., chief chemist at Benrus Watch Co. and chemist and plating foreman at Oakville Co. Division, Scovill Mfg. Co. Mr. Sloane was graduated from Columbia University and attended Ohio State University Graduate School.

Mr. Cross has been actively engaged in the metal and organic finishing field for many years, both as production supervisor and as a consultant. He was associated with the Turner & Seymour Mfg. Co. and H. Goodman & Sons as finishing supervisor and was one of the principals of the former Hycrow Co. He is also one of the pioneers in vacuum evaporation. Mr. Cross was graduated from the College of The City of New York and continued his education at Brooklyn Polytechnic Institute Graduate School.

Three New Directors Named to American Platinum Works Board

Three new directors have been elected to the board of directors of the *American Platinum Works, Charles Engelhard*, president, announced here today. The company is a member of the Engelhard Industries group.

Those named are: *William J. Wagnitz*, general sales manager; *John F. Thompson, Jr.*, sales manager for the silver brazing alloy division; and *Otto W. Langhans*, works manager.

The three men total better than 36 years of service in the Engelhard Industries group. Mr. Wagnitz, a resident of Franklin Lakes, N. J., has been with the company 13 years. Mr. Thompson, of 1 Clark Place, Brooklyn, N. Y., joined Baker & Co., Inc., of Newark, also a member company of the group, after World War II and has been with American Platinum Works for the past four and a half years. Mr. Langhans, of 19 Norman Circle, Madison, N. J., has the longest service record, having been with the company 17 years.

Rosen Joins Aceto

Irving Rosen has joined the staff of *Aceto Chemical Co., Inc.*, Flushing, N. Y. as general executive assistant. He was formerly with the Dura Commodities Corp.

New Diversey Field Representatives

Well prepared to serve the metal industries are these new D-Men, field representatives of the *Diversey Corporation's* Metal Industries Department, Chicago. They have just completed an

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CUTMASTER by Williamsville is precision-designed for automatic buffing—cut on the bias for longer wear—engineered for cool-running and perfect balance to give extra hours of trouble-free service. Ask us to show you how CUTMASTER can cut costs on your automatic buffing jobs now!

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intensive technical and sales training course and will sell prefinishing cleaners and etchers to the metal working field.

Standing (l. to r.) *W. B. Drake* (Central Division); *E. B. Willey* (Pacific Division); *R. E. Erickson* (Pacific Division); *Gene Hasson* (Central Division); *H. G. Spotts* (Pacific Division).

Seated (l. to r.) *Wyne Polzin* (new assistant manager) *R. L. Shannon* (manager of the Metal Industries Department); *R. O. Bennett* (Central Division).

Houghton Plans Expansion of Research Facilities

Plans for an expanded research program, including a further addition to its laboratories, have been approved by the board of directors of *E. F. Houghton & Co.*, manufacturers of oils, chemicals and hydraulic leathers.

An additional floor will be added over the present research laboratory to provide required facilities for the program, and the staff of chemists will be increased. This expansion is particularly aimed at four fields, all of which represent areas of interest consistently covered by this company in past years.

Construction will begin this Fall, with the hope of starting on this further research program early in 1954. Houghton's present laboratory was built in 1928 and an addition constructed in 1941.

Changes in Oakite Management Organization

Following a recent meeting of the board of directors of *Oakite Products, Inc.*, manufacturers of industrial cleaning and allied materials, three changes in the management organization were announced. *J. J. Basch*, former Philadelphia division manager and veteran of 28 years service with the company, was appointed manager of research

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and product development. He will be in charge of the company's expanding technical research program, and will supervise the field testing of new and experimental materials. A member of the company's board of directors since 1948, he has also been elected a member of its executive committee.

At the same meeting, *E. H. Steif*, general attorney of the company and member of the Oakite organization since 1948, was appointed assistant secretary and elected to the board of directors. Another appointment announced was that of *W. A. Baltzell*, former southern division manager and with the company since 1941, as assistant sales manager. He will assist the general sales manager of the company's industrial division in connection with sales management functions.

Richard L. Mullaney

Algird J. Brazanskas

Apothecaries Hall Appoints Mullaney and Brazanskas

Richard L. Mullaney, Jr. has been appointed a senior chemist by the *Apothecaries Hall Co.* of Waterbury, Conn. He will assist in the development of metal finishing specialties and will also be available for technical service work related to metal finishing problems. Mr. Mullaney is an honor graduate in chemistry from St. Anselm's College. Before joining Apothecaries Hall he had been a plating chemist with Pratt & Whitney Aircraft and a plating supervisor and chemist at the Trumbull Electric Co.

Algird J. Brazanskas has also been named an assistant chemist by the company. He will work on research and development problems in metal finishing. Mr. Brazanskas is a graduate of the University of Connecticut where he majored in chemistry. He is a member of *The American Chemical Society*.

BUYERS *of any QUANTITY of the following SCRAP*

Ni—Anodes
Ni—Peelings . . . Strippings . . . Nodules . . . Trees
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Tin—Plating Residues
Cadmium—Trees . . . Strippings . . . Nodules . . . Trees . . . Residues
Molybdenum—Tungsten
Gold—Silver
Platinum—Scrap . . . Residues . . . Strippings

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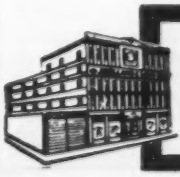

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Federated Opens New Research Foundry

R. D. Taylor, assistant to the vice-president in charge of development, and *Donald L. LaVelle*, metallurgist in charge of foundry research, pour the first casting made in the new *Federated Metals Division* research foundry at South Plainfield, N. J.

Federated, a division of *American Smelting and Refining Co.*, has installed in this new research foundry all the modern equipment necessary to make it a proving ground for the solution of typical problems besetting company customers. Particular attention, both from a research and from a practical standpoint, will be given to melting techniques, gating practices and pouring procedures. There will be ample opportunity, too, for the testing of newly developed alloys in the same way that customers would be using them.

Metalweld Appoints Adams Sales Engineer

Henry W. Adams has joined the MW Protective Coatings Division of *Metalweld, Inc.*, as a sales engineer.

He will service accounts with the company's complete line of protective coatings and linings.

Mr. Adams was formerly regional field representative for the *Amercoat Corp.*

Battelle to Build New Laboratory

Construction has begun on a new laboratory building to house chemical research at *Battelle Institute*, Columbus, Ohio, *Dr. Clyde Williams*, Institute president, announces. Workmen are now preparing the foundation for the new structure to be built at an estimated cost of $1,400,000.

In announcing construction plans, Dr. Williams said that the new building will provide 100,000 square feet of additional laboratory space to help meet the continuing space requirements of research for both industry

Simplify your bright zinc plating with

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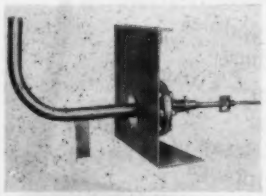
***FERROLUM ANODES**

1. Permanently Rigid — Excellent Conductivity — Lighter in Weight — Long Life — Economical.



2. *FERROLUM GAS HEATER

Low fuel cost, simple to operate, direct fired. Efficient, compact, economical, simple to operate and install. Sturdy, excellent corrosion resistance.

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High efficiency, low steam pressure. Large heating surface — Economical and efficient.

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and government. Battelle has conducted an almost continuous building program since 1935. Indicative of the research center's growth is its increase in personnel. The present staff of 2,100 is more than double that employed at the close of World War II.

The new building—Battelle's seventh major structure in Columbus—is slated for completion in the fall of 1954. The four-story brick and concrete structure will have outside dimensions of 63 by 290 feet. Plans include provision for space for pilot plants used in chemical engineering research.

H-VW-M Makes Three New Eastern Appointments

Hanson - Van Winkle - Munning Co., manufacturers of plating and polishing equipment & supplies, announces three new appointments of sales representatives for territories along the middle and south-eastern seaboard. *Howard L. Wright* will cover the Philadelphia area, south-western New Jersey and easternmost Pennsylvania. Assisting him will be *Frank W. Mountain. Thomas M. Rodgers* takes over territory south of Wilmington.

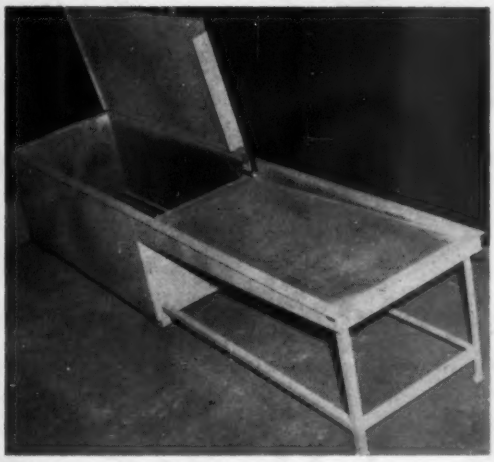
Frank W. Mountain

Howard L. Wright

Wright will be district manager, with headquarters in Philadelphia. With H-VW-M for seven years, he has previously covered Pennsylvania, New York and states in the Southeast. He is a graduate of Franklin & Marshall, spent four years in the U. S. Navy during World War II.

Mountain moves to his new position after receiving a year's training in the company's laboratory at Matawan. He is a graduate of Colgate University, 1950.

Rodgers, whose headquarters will be in Baltimore, moves South after representing the company for the past six years in eastern Pennsylvania. He is a past president of the Philadelphia Branch of the *American Electroplaters' Society*, a member of *The Electrochemical Society*, *American Society*



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Service: Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.

Design: Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg, or Sethrin* resin. Filter Tubes of cotton, dynel, porous stone, or porous carbon. Pumps fabricated of Hastelloy, stainless 316, or plastic; centrifugal or self-priming. Motors drip-proof, totally enclosed or explosion-proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. Hose — 12 ft. inlet and 12 ft. outlet acid and alkaline resistant. Base — phenolic base on rubber tire ball bearing casters.

Self-Priming MODEL LSIN-10 Cap. 100 gal/hr H. T. Lucite Filter Assembly

Stainless Pump Totally Enclosed Motor Portable—Wt. 60 lbs. 14" x 16" x 16" high

Distributors in Principal Cities

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb.
LSI-10	100 "	12" x 16" x 16"	40 "
ASI-300	300 "	2' x 2' x 2'	125 "
ASI-400	400 "	2' x 2' x 2'	135 "
ASI-600	600 "	2' x 2' x 2'	150 "

*REG. APP. FOR

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Thomas M. Rodgers

for Metals and is a registered professional chemical engineer in the state of Pennsylvania. He attended the University of Pennsylvania and Swarthmore College, and served as a Naval Reserve officer for 5½ years during World War II.

Cogshall Rejoins Pennsalt

After two years service as a Lieutenant Commander in the Navy, *James H. Cogshall* has rejoined the *Pennsylvania Salt Manufacturing Co.* as a sales engineer in the Corrosion Engineering Products Department in Philadelphia.

Before Mr. Cogshall was called to the Navy in 1951, he served as a corrosion engineer at the company's Wyandotte, Mich., plant, where he supervised a study of the use of protective coatings in Pennsalt's plants.

A member of the *American Chemical* and the *National Association of Corrosion Engineers*, he and Mrs. Cogshall make their home in Ambler, Pa.

Grader New Heil Representative

Heil Process Equipment Corp., manufacturers of chemical proof tanks, tank linings, impervious graphite heat exchange equipment, lead anodes, steam jet agitators and Rigidon plastic exhaust hoods and duct work, has recently appointed *Ken W. Grader* as Chicago district representative. He will make his headquarters at 400 W. Madison Ave., and will be able to offer immediate assistance to the many Heil customers in the steel industry, chemical industry and electroplating industry in this area.

Ken W. Grader

Mr. Grader received his chemical engineering degree from Case Institute of Technology and has had sixteen years' experience in the sale and service of chemical-proof process equipment. During the past three years he has been sales engineer in the eastern home territory of the company.

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easy to control . . . cuts down on trouble that entails costly delays.

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gives unbelievable uniformity of deposit in recesses . . . brighter, white color.

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Vanton Pump Changes Name

A change in company name from *Vanton Pump Corp.* to *Vanton Pump & Equipment Corp.* was announced today by *J. J. Ashton*, president. Mr. Ashton explained that the new name was decided upon in view of Vanton's addition of corrosion resistant plastic and hard rubber valves, pipe and fittings to its regular line.

It has also been announced that the manufacturing plant has been moved from its present location in Long Island City, N. Y., to a new building on the premises of its affiliate company, The Cooper Alloy Foundry Co., Hillside, N. J.

Executive and sales offices will remain at the Empire State Building, New York 1, N. Y.

Cowles Appoints Sayers

Cowles Chemical Co. of Cleveland, Ohio announces the appointment of *Clay A. Sayers* as technical man in the metal cleaner department for the sales territory of Southern Ohio, Indiana and Kentucky.

Clay Sayers is well qualified to give

Clay A. Sayers

valuable assistance to industrial metal working companies having had extensive experience in industrial selling and in the polishing and plating fields. He will make his home at 1981 Seymore Ave., Cincinnati 37, Ohio.

Promotions at Diamond Alkali

Promotion of two veteran excutives to vice-presidencies and formation of two new autonomous divisions in *Diamond Alkali Co.* were announced here today by president *Raymond F. Evans* following a meeting of the board of directors.

W. H. McConnell, director of sales, has been elected vice-president—sales. *C. E. Lyon*, works manager of Diamond's electrochemical plant at Houston, Tex., also becomes a vice-president.

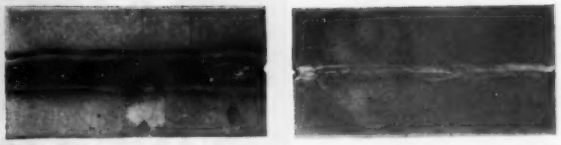
The two new autonomous divisions are the Plastics and Agricultural Chemicals Division with *A. L. Geisinger*, a vice-president, as general manager of the division; and the Chromium Chemicals Division with *Frank W. Jarvis* as general manager. Mr. Jarvis since 1951 has been president of Diamond Magnesium Co., a subsidiary of Diamond Alkali, and previously was president of the Fairport, Painesville and Eastern Railroad.

Seymour Joins Butcher Staff

The metal finishing department of the *L. H. Butcher Co.*, a subsidiary of the *Udylite Corp.*, has announced the appointment of *Dave F. Seymour* to its technical service staff.

Mr. Seymour, a chemical engineer,

Pressure Blast Application #182



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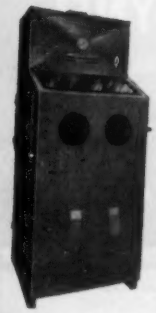
This strip of 430 type 14 gauge stainless steel was prepared for welding by Pressure Blasting in order to achieve a clean, microscopically etched, easy-to-bond surface. The weld discoloration, flux and spatter was removed in 10 seconds with no measurable loss of stock! Micro-inch finish was improved, too!



MODEL A . . . ONE OF 4 STANDARD UNITS. CUSTOM MACHINES DESIGNED TO FIT SPECIAL REQUIREMENTS.

ONLY PRESSURE BLAST GIVES YOU 2-SPEED WET-BLASTING

FREE . . . Learn what PRESSURE BLAST can do for you! Die and Mold Polishing, Blending Grind Lines, Deburring, Heat Treat Scale Removal, Honing of Cutting Tools, Pre-plating Cleaning . . . Hundreds of proven, money-saving applications!

Write for our new 8 page fully illustrated Booklet . . . or send samples of work you want tested to:

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More lives than a cat ...Monel

You get more service life out of Monel® pickling equipment than a cat gets out of his nine lives.

In pickling operations, Monel withstands the corrosive action of acids. It's tough. It's durable. Gives years of trouble-free service. And it can readily be repaired to give it a new lease on life.

These days it is advisable to place equipment orders with your supplier well in advance of scheduled use. Distributors of Inco Nickel Alloys can supply the latest information on availability from warehouse and mill. Meanwhile, write for a copy of "5 Way Savings . . . in Pickling." It's yours for the asking.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Monel PICKLING EQUIPMENT
extra life
extra capacity
extra safety

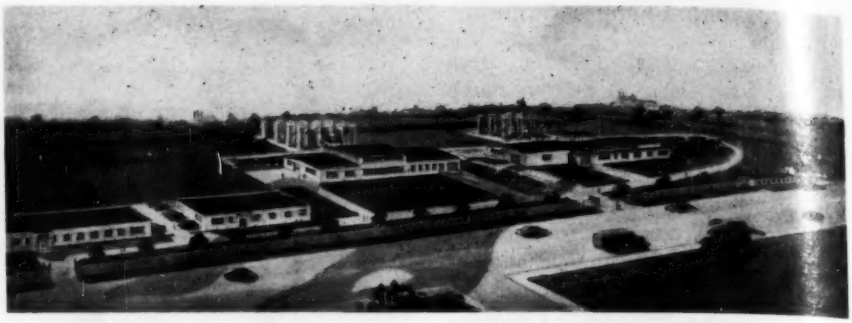
having had five years of chemical and metallurgical engineering at the University of Minnesota, devoted time in welding rod and steel case production prior to developing interest in the metal finishing field. Diversified experiences in research as well as service was obtained through employment at the Promat Division and later as factory manager for the Pacific Coast Division of the *Diversey Corp.* of Chicago.

Mr. Seymour will devote his entire time to the sales and service of Enthone products for the Western area.

New Nox-Rust Plant

The *Nox-Rust Chemical Corp.*, Chicago, was recently completely installed in its new plant at 47th St. and Central Ave., according to an announcement made by *George A. Daubert*, president.

The new manufacturing facilities of the ultra-modern plant, situated on approximately 15 acres of land on Chicago's outskirts, will enable the company to step-up production about 100 per cent. Both the executive and



sales offices will move into their new downtown location at 333 North Michigan Avenue.

For many years, the plant and offices have been located at 2429 S. Halsted St., Chicago. Founded on this location in 1935, the firm has since become nationally and internationally known as manufacturers of a large line of petroleum chemicals and rust preventive products.

Titeflex Filter Sale to Wagner Bros., Inc.

Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J., announces the sale of the design and manufacturing rights of their industrial filter for the electroplating market to *Wagner Bros., Inc.*, 400 Midland Ave., Detroit 3, Mich., distributors of equipment to the industry. Titeflex still retains the design and manufacturing rights of its filters for the chemical and other industries.

With the addition of the Titeflex filter, Wagner Bros. will become both manufacturers and distributors of filters and filtration equipment. Their present facilities consist of three plants in the Detroit area, backed up by a national sales distribution.

John D. Tebbin, vice-president of Wagner Bros. and president of *Wag-*

today's "wonder drug" for industry

The greatest cost-saving labor-saving* FINISHING DEVELOPMENT *in a decade!

If you produce parts that require finishing, write today for *NEW, FREE* eye-opening 52-PAGE CATALOG, *"Supersheen Speed Finishing."* Learn how Supersheen Speed Finishing saves up to 95% on almost all types of parts with absolute uniformity, fewer rejects, finer finishes!

DEPT. B-10

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT – MATERIALS AND COMPOUNDS

ALBERT LEA, MINNESOTA

Do you work with ACIDS AND CHEMICALS?

NOW SAVE UP TO 80% on work clothes cost!

WORKLON

Industrial Apparel of acid and chemical resistant DuPont **ORLON*** or Union Carbide **DYNEL**

★ ACID, CHEMICAL AND ABRASION RESISTANT!

★ U.S. NAVY SAYS: OUTWEARS COTTON 50 TO 1

★ LAUNDERS AND DRIES QUICKLY – NO IRONING!

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WORKLON, INC. Dept. MF10, 253 West 28th St., New York

FREE! Rush WORKLON's new, fully illustrated catalog of ORLON, DYNEL, and COTTON WORK CLOTHES.

Firm Name.....

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ner Bros. Equipment Co., stated that the filter would be manufactured at the Wayne, Mich. plant, where production is getting under way promptly to take care of present distributors.

Davies Appoints E. F. Conroy and John Kurdenok

E. F. Conroy, Jr. has been appointed vice-president in charge of sales by the *Davies Supply and Mfg. Co.* of St. Louis, according to *L. A. Davies*, president of the firm.

Prior to World War II, Mr. Conroy was in the tin mill metallurgical department of the Weirton Steel Co., Weirton, W. Va. From 1941 to 1946, he served with the Air Force, mostly in the European theatre. He joined the Davies sales force in April 1946.

Mr. Davies also announced that *John Kurdenok* is now Chicago and Detroit representative for Davies plating racks and coatings.

Kurdenok, who attended Illinois Institute of Technology, has wide experience in the plating field. From 1935 to 1947, he was with the Houdaille Hershey Corp., the Dodge Chicago plant and the General Mills Co., Minneapolis. He was superintendent and vice-president of the Standard Plating Rack Co. from 1947 to 1951 and more recently was vice-president of the American Plating Rack Co. of Chicago.

E. F. Conroy

John Kurdenok

Chemists & Engineers 25th Anniversary

The *Association of Consulting Chemists and Chemical Engineers, Inc.*, will celebrate its twenty fifth anniversary on Tuesday, October 27, 1953 at 6:00 p.m. at the Belmont Plaza Hotel, Baroque Room, New York City.

For reservations the Association may be contacted at 50 East 41st St., New York 17, N. Y. not later than October 15th. Participation is not restricted to members only — guests are welcome.

The program will include a banquet,

WHY BOSSES GET GRAY
GRRR!
WHAT'S EATIN TH' BOSS?
BOY, HE'S GOIN' CRAZY WITH ALL THOSE SOURCES OF SUPPLY! HE'D GIVE A BONUS IF SOMEONE WOULD TELL HIM WHERE HE COULD GET THAT STUFF AT ONE PLACE!
IF YOU HAVE THIS PROBLEM- SCHAFFNER CAN SOLVE IT..
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CHARLIE, I GOT MY LITTLE 25 POUND ORDERS JUST AS FAST WHEN I WAS JUST GETTING STARTED... THAT'S WHY IT'S ALWAYS SCHAFFNER COMPOUNDS WITH ME!
WRITE US TODAY ---→ SCHAFFNER MFG. CO., INC. EMSWORTH, PITTSBURGH 2, PA.
Write today for free new Catalogue and Samples - Schaffner Mfg. Co., Pittsburgh 2, Pa.

dance and dinner music, top-flight entertainment and many surprises.

Hample Heads Technical Council

Clifford A. Hampel, chemical engineering consultant, of Homewood, Ill., has been elected president of the *Chicago Technical Council*, a federation of scientific, engineering, and technological societies.

Mr. Hampel succeeds *Dr. Chris E. Barthel, Jr.*, Chicago, now resident director, State and Industrial Research Institute, Rangoon, Burma.

Other officers named are: *Jay C. Marshall*, Proctor & Gamble Mfg. Co., first vice-president: *Russell B. Snyder*, The Rauland Corp., second vice-president; *E. J. Pavesic*, Lindberg Steel Treating Co., secretary; and *Edmund Field*, *Standard Oil Co.* (Indiana) treasurer.

Mr. Hampel is editor-in-chief of the Encyclopedia of Chemical Reactions and is currently engaged in editing a forthcoming Handbook of Rare Metals. He is vice-chairman of the Chicago Chapter, *American Institute of Chemists*, and is a member of the

Clifford A. Hampel

American Chemical Society and *Electrochemical Society*.

Pennsalt Enters Paint Bond Field With New Line

The Pennsylvania Salt Mfg. Co. has entered into the field of chemical specialties for phosphatizing metals for corrosion resistance and paint bonding with a complete line of products for this field under the trade name "Fosbond," it was announced recently by *William P. Drake*, vice-president.

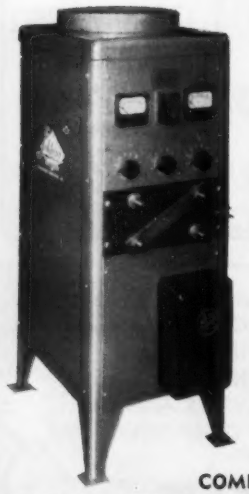
For the past several years Pennsalt has been manufacturing and marketing phosphate coatings, metal cleaners and lubricants for the cold working of steel. The new line rounds out the company's activities in the entire field of phosphate coatings and virtually completes its line of metal processing chemicals.

The company has organized a field technical service staff and established a new technical service laboratory at its Whitemarsh Research Laboratories to provide a maximum of engineering and technical service to customers.

The new line includes a virtually complete range of phosphating compounds for application of various types of iron phosphate, zinc phosphate or manganese phosphate coatings. In addition, the company has developed a complete new line of compounds for surface preparation prior to phosphating. These cleaning and surface preparation compounds employ new activators which improve control of the ultimate coating desired.

In one series of these products the cleaning and phosphating actions are combined, thus eliminating one step

BUY Lektron® RECTIFIER For the Finest in PLATING RECTIFIERS



A BETTER SOURCE OF DC POWER — MORE FOR YOUR MONEY

Now Lektron plating rectifiers are available in two types. (1) Lektron Selenium for cool zones, or (2) Lektron Magnesium-Copper Sulphide for the hot, dirty, tough jobs. Heavy duty transformers — husky fan motors — built to last. Built-in voltage regulation — meters — or remote control optional.

Units operate from minus 40° F. to 225° F. at 50 - 50,000 amperes DC. No failures in units working 4 years "round the clock." Investigate "LEKTRON" before you buy — get quality of product backed by a company of integrity at a "price you can afford."

COMPLETE ENGINEERING SERVICE

Illustrated — 750 amperes 2-16 volts to 1500 ampere 1 - 8 volt DC. Full wave type with builtin regulator. For use with 208, 220 or 440 volt 3 phase AC. 20" x 26" x 56½" steel cabinet in gray hammerloid. Weight 725 lbs.

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We can supply all or any part of your filtering and filling equipment.

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- FITTINGS
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We invite your inquiries.

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in the cycle. Other cycles have been arranged to provide coatings of minimum weight, yet uniform and very fine grained. Such coatings give the metal more than adequate corrosion resistance and paint bonding action and make possible very smooth finished painted surfaces.

Raybestos-Manhattan Ups Kuzmick

Joseph N. Kuzmick has been appointed coordinator, corporation research and development by *Raybestos-Manhattan, Inc.* His duties will extend to all Divisions of the corporation and he will headquarter at Passaic, N. J. Mr. Kuzmick has been with the *Manhattan Ruber Division* for over thirty years during which he has been active in the development of asbestos and sintered metal friction materials, abrasive and diamond wheels, resins, plastic products and bowling balls.

OBITUARIES

J. J. SIEFEN

J. J. Siefen, president of the *J. J. Siefen Co.*, Detroit died on August 23, 1953 at his home in Detroit at the age of 78.

J. J. Siefen

Mr. Siefen formed the company bearing his name in 1927 as a jobber of plating and polishing supplies and equipment. He learned his trade in Germany and after coming to this country at the age of 16, became foreman of a brass plating shop at 19. Thereafter followed years as supervisor, factory manager and general manager in various metal finishing factories until 1927.

Mr. Siefen was active in the business until shortly before his death. He had changed it into a manufacturing concern of buffing and polishing materials, the most noted development being the successful practice of spraying buffing and polishing compounds.

He was a member of the Detroit Branch of the *American Electroplaters' Society*.

LITTLETON C. BARKLEY DIES

Littleton C. Barkley, 51, general sales manager, West Coast Division of *Raybestos-Manhattan, Inc.*, died Thursday, August 27, at San Mateo, Cal.

Mr. Barkley joined the company, in 1926. Two years later he was transferred to the New York office as a salesman and was made assistant branch manager in 1937. He later served as manager of the New York Branch from 1940 until 1944, when he was appointed sales manager of the Industrial Rubber Products Division at Passaic. In 1948 he became general sales manager of the West Coast Division.

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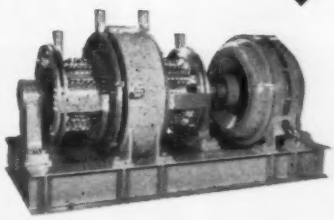

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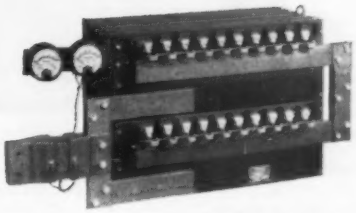

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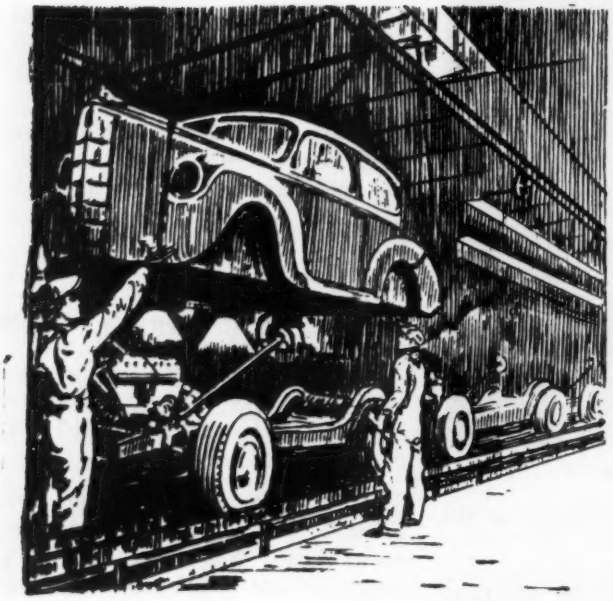


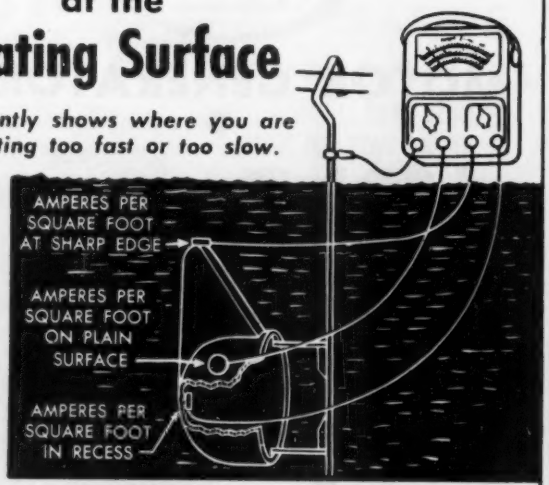
MOTOR CITY PLATING NEWS

Detroit Branch

The Detroit Branch of the *American Electroplaters' Society* held their Annual Stag Day Outing on July 18th at the Glen Oaks Country Club in Farmington, Mich. In spite of a rainy morning, over 900 members and guests were on hand, this being an all-time attendance record. Since the entire facilities of the Country Club were reserved for the Stag Day guests exclusively for the entire day, the heavy

Measures Current Density at the Plating Surface

Instantly shows where you are plating too fast or too slow.



Yes—the BELKE-KOTZ Meter eliminates guesswork—delays—spoilage — and tedious measurements. Shows instantly current density at three selected locations on the article—with the article in any position.

NO FIGURING. Meter shows amperes per square foot — affords direct comparison with current density table for the solution you are using. Eliminates trial and error. Enables you to plate to specifications at lowest cost.

Ask your BELKE Service Engineer or write —

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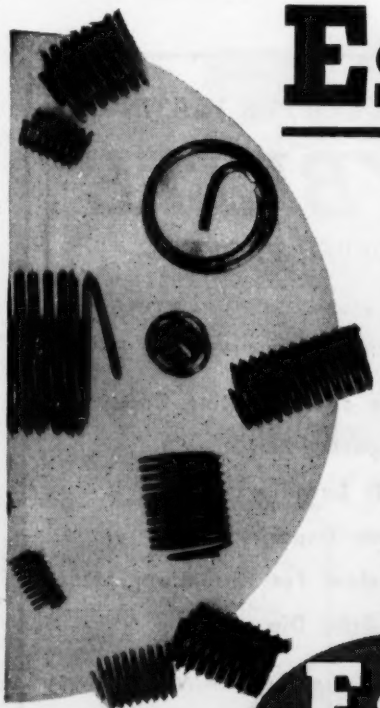
EVERYTHING FOR PLATING PLANTS



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PERMA BLACK PROCESS
18-8 stainless steel springs blackened to government specifications in addition to all other ferrous metals

Operating costs reduced **40%**

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PRODUCTS

Perma Black Metal Cleaners | Soluble Oil Additives | Brazing Flux

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turn-out did not present any problems.

The planned activities which included breakfast, golf, archery, bait casting, pie eating and egg throwing contests, tug-of-war, and other events were carried out smoothly and participation and enthusiasm indicated that everyone enjoyed them thoroughly.

Door prizes weer given to all and refreshments were available throughout the day without charge.

For the day's climax an excellent roast beef dinner was served at 6:00 P.M. complete with dinner music by strolling musicians.

The Stag Day committee was headed by *A. J. Emmerich*, general chairman who was assisted by *Walter Pinner, Cleve Nixon, John Siefen, Guy Cummings, Fred Wagner, Wright Wilson, Herb Head, Les Borchert, Frank Clifton, Ed Kubis* and others.

Tebben Heads New Equipment Firm

John D. Tebben, well known management consultant, has been elected president and chairman of the board of the recently organized *Wagner Brothers Equipment Co.*, which started operations in June, at 42056 Michigan Ave., Wayne, Mich.

The firm was formed by a group of employes of *Wagner Brothers, Inc.*, manufacturers and warehouse suppliers to the plating industry, and will build electroplating equipment, headlined by a revolutionary, fully automatic electroplater. Other items include electroplating rectifiers, a package unit plater, semi-automatics, agitators, tanks and anode containers. Delivery of the firm's first fully auto-

John D. Tebben

BETTER COMPOUNDS *mean* MORE PRODUCTION *and* INCREASED PROFITS

Thirty years of experience developing and furnishing Polishing and Buffing Compounds to the Automobile Industry and hundreds of allied metal working firms entitles us to solicit the opportunity of working on your polishing and buffing problems.

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DETROIT CHEMICAL SPECIALTIES, Inc.

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Technique of Spray Painting

By ARTHUR L. PHILLIPS

Reprints of this article which appeared in the August issue of *Organic Finishing* are available, free of charge, by request on your Company Letterhead.

Send Requests To

METAL FINISHING

381 BROADWAY, WESTWOOD, N. J.

matic plater is expected to be announced within a week.

A division of the new firm is being organized to install tank linings, using a newly developed material of superior resistance to corrosive chemicals of all kinds. Modern facilities for lining with standard materials also will be installed in the new division.

Mr. Tebben, who has been connected with Wagner Brothers, Inc. for the past year has served as management consultant for many leading firms in the metal working industry, as head of the John D. Tebben & Co. He plans now to devote his full time to Wagner Brothers Equipment Co., Transformers, Inc., and Wagner Brothers, Inc., of which he is vice-president and director.

Norton Joins Stevens Staff

Patrick H. Norton has joined the sales engineering staff of *Frederic B. Stevens, Inc.*, manufacturers of metal finishing equipment and supplies. He will cover the western Michigan territory with headquarters in Grand Rapids.

Patrick H. Norton

Prior to joining the company, Pat served two years as a counter-intelligence agent with the U. S. Army. He also worked as a field engineer for Brown Instrument Division, Detroit, before being called to active duty. He is a graduate of University of Detroit with a degree in Mechanical Engineering.

Smolinski Heads Wagner Tech. Service

Theodore C. Smolinski, has been appointed director of technical service for *Wagner Brothers, Inc.*, electroplating warehouse suppliers and manufacturers. Since his graduation from Michigan State College in 1942 with a B.S. degree in Chemistry, he has worked on plating and chemical problems for Oldsmobile, Packard and Ainsworth Mfg. He joined the company in June of this year.

Lawson Heads Detroit Sales for Circo

The appointment of *Jack E. Lawson* to head sales in the Detroit area of Circo vapor degreasers and other metal cleaning products has been announced by *Melville Morris*, president of the *Circo Equipment Co.* (formerly Topper), 120 Central Ave., Clark Township (Rahway), N. J.

Mr. Lawson has specialized in this field in the Detroit area for approximately 20 years. In this career, he is credited with selling more degreasers and trichlorethylene than any other

SOMMERS BROS. MFG. CO.
MFRS. OF "BEACON"
Plating and Polishing Supplies and Equipment —Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.
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Truly—Three Great Finishes!!
CHROMIUM - UDYLITE
SHERARDIZING
For over a quarter of a century building and installing portable sherardizing furnaces and equipment: metal finishing and plating.
We invite your inquiry.
THE NATIONAL SHERARDIZING & MACHINE CO.
OFFICE & FACTORY: HARTFORD, CONN.
Foreign Representatives—
Oliver Bros., Inc., 417 Canal St., N. Y. City

Doesn't YOUR product deserve a MOCO surface?
MOCO BUFFING COMPOUNDS
The "Long Mileage" line for all finishing requirements
MOCO TUMBLING BARREL COMPOUNDS
To keep pace with modern barrel finishing techniques
WE INVITE YOUR INQUIRIES
THE MOSHER COMPANY · 15 Exchange St., Chicopee, Mass.

MANUFACTURERS OF ALL PURPOSE
CLEANRITE
METAL CLEANERS AND BURNISHING COMPOUNDS
HAY CHROME SALTS—Increases Chrome Throwing Power
GLO DIP—For Bright Dipping Copper, Brass and Bronze
SPECIALISTS IN THE ENGINEERING OF ELECTRICAL IMMERSION TYPE TANK HEATERS.
Call on us for the answer to your difficult problems.
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JACOB HAY COMPANY
Centralized Manufacturers and Distributors
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Jack E. Lawson

individual, and is considered a national authority on metal cleaning.

Graduated from the University of Detroit with a Mechanical Engineering degree, he first entered the degreasing field as a designer and engineer in 1933. He entered the sales field a year later and has been in sales work since that time. He is a member of the Engineering Society of Detroit. He is married and has three sons. A favorite hobby is golf. Mr. Lawson will be located at Circo's Detroit office, 18032 James Couzens Highway, Detroit 35, Mich.

Houdaille-Hershey Appoints Pinner

The appointment of *W. L. Pinner* as manager of the *Process Development Division* of *Houdaille-Hershey Corp.* has been made known by *Frank G. Fisher*, vice-president and general manager.

Pinner will head up a unit of the corporation which coordinates technical control of its manufacturing operations with process development in metallurgical, electrochemical, painting and other fabrication activities.

An employee of the company since 1923, Pinner is a chemical engineering graduate of the University of Michigan. He is widely known in the metal finishing field, having served

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For color and lustre beyond compare, specify INDIAN BRAND TURKISH EMERY. Preferred by those who know the best.

Also available — HECCO BRAND AMERICAN EMERY, for use in abrasive pastes and compositions.

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"THERE'S NO TIME

like the present" to improve your knowledge of modern electroplating techniques. You can gain this knowledge easily and pleasantly through my unique home study course. Once gained you'll profit continuously from it. Write for the facts today. No obligation. **Joseph B. Kushner, Electroplating School, 115 Broad St., Stroudsburg 13m, Pa.**

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GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a complete line of buffs including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

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"Gives our tools Sales Appeal"

BARNABY MFG. CO. of Bridgeport, Conn., reports: "Our close proximity to salt water has given us problems in rust prevention for many years. We have experimented with many black oxide finishes but none has proven as successful, safe, and inexpensive as DU-LITE—our tools have better sales appeal—our volume has been on the increase ever since we started using this modern, progressive oxide finish."

Depend on Du-Lite, the metal-finishing specialists, for the most efficient and economical cleaners, black oxide finishes and phosphate coatings. Write for full details on:

- Du-Lite Black Oxide for Steel.
- 3-0 Black Oxide for stainless steel and malleable iron.
- SD Compound for removing occluded salts.
- Phosteel and Phospray for phosphatizing steel, iron or zinc.
- Du-Lite Non-Acid Black Oxide for copper and copper alloys.
- Dynakleen for bright cleaning all metals.
- Kwikseal and Proctoil water displacing oils.

Or send us samples of parts and we will process them for your approval.

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Send information on metal finishing products.. ☐

Have your representative call..... ☐

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Company.....

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City..... Zone..... State.....

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METAL FINISHING SPECIALISTS

W. L. Pinner

as president of the *American Electroplaters' Society* and enjoying the distinction of having been the first American to be elected to Honorary Membership in the *Institute of Metal Finishing* of England.

Also announced was the appointment of *William J. Pierce* as supervisor of process development, in direct charge of research and development activities in this division. Mr. Pierce, who holds a chemical engineering degree, has served the company since 1937 and has also specialized in processes involving metal fabrication and finishing.

Bender Rejoins F. B. Stevens

Roman C. Bender has rejoined the metal finishing equipment and supplies sales staff of *Frederic B. Stevens, Inc.* He will cover the state of Indiana and operate from the company's Indianapolis branch at 36 Shelby St.

Bender's combined experience, in both the polishing and plating lines, total over 20 years. Five years of this experience was gained while serving as a Stevens representative immediately following World War II.

He is an active member of the Indianapolis Branch, *American Electroplater's Society*.

NEW BOOK

Metal Industry Handbook & Directory

Published by Louis Cassier Co., Ltd., Dorset House, Stamford St., London, S.E.1, England. 1953. 456 pages. Price $7.50 (Includes yearly subscription to Metal Industry).

This comprehensive volume which is available only to subscribers to Metal Industry, our British contemporary, is the 42nd yearly reference book of the British metal industries. Although it includes a section on the standard metal finishing processes, its great value lies in the exceptionally thorough compilation of general tables and data on commercial metals of all shapes and types, including a 280-page section on their general properties. An extensive section is devoted to British standards and specifications, in abbreviated form.

SHOP PROBLEMS

(*Continued from page 85*)

Finish for Gun Barrels

Question: I am planning on doing an amateur or home finishing job on a couple of old guns I have had for a number of years.

In my 1953 METAL FINISHING Guidebook Directory I find the "browning" process to be highly recommended. However, I am wondering if this is an old finish used years ago or a finish

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INCLUDING PATENTED, VENTILATED & BIASED
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WE WANT new products to sell. We want new ideas to develop for the national metal finishing market. Our active sales force is your assurance of volume. Our technical staff will develop or service your product, our manufacturing facilities will produce it, and our sales organization will distribute it nationwide with profit and protection for you.

Phone, wire or write
JOE WAGNER
Wagner Bros., Inc.
Midland at Ross
Detroit 3, Mich.

which is being used on newest guns of 1953. Would you advise this finish as being superior to the regular blueing finish on most guns? What blueing process would be most durable of those listed in the Guidebook?

J. C. L.

Answer: The most common finish on modern guns is what is known as the "caustic black." Formulas in the 1953 edition of the METAL FINISHING Guidebook on page 443 under "Coloring Steel" are employed, or the salts can be obtained in prepared form from suppliers listed on pages 514-5 of this issue.

All the brown, blue or black finishes require oiling or waxing for protection.

Stripping and Replating Chromium

Question: How might I chrome strip and replate nickel-plated steel and aluminum parts? I will want to do this without having a frosty finish in scattered areas of the plate.

R. K.

Answer: The standard procedure is to strip the chromium from the nickel with concentrated muriatic acid. The surface is then activated by a direct current treatment in an alkaline cleaner, followed by a dip in 20% sulfuric acid. Watch the rinsing after the sulfuric dip to avoid dragging sulfate into the chromium solution.

Coatings in Contact with Foods

Question: In all cases where customers are manufacturing items which come in contact with food and we are asked to cadmium plate as a finish, they are advised of the dangers of cadmium and asked to revise their specification. Recently a customer became indignant over our suggestion along this line and let us know they had been marketing cadmium plated articles for some time. About the same time our local Department of Health demanded a clean-up of a restaurant's sink drain board and refused to sanction the use of zinc plate.

We are now a little confused as to what is suitable as a finish for food implements and would appreciate any information you might be able to give.

J. F. C.

Answer: Many municipalities have ordinances prohibiting the use of cadmium, zinc or lead in contact with food. None of these metals should be considered as coatings for items which come in contact with food products. Tin or nickel-chromium deposits will be quite satisfactory for the purpose.

Anodizing in Bulk

Question: We are experiencing considerable difficulty in the anodic treatment of small parts, such as small washers and rivets. We have tried several sizes and designs of baskets, but only a small percentage of the load is acceptable.

Can you offer any advice or suggestions for the treatment of such parts to produce a uniform coating without individually racking each piece? Any advice will be greatly appreciated.

L. A. H.

Answer: Rivets may anodize satisfactorily if small and large sizes are mixed. Small rivets pack too tightly to permit circulation of solution. Since washers or any other flat parts tend to stick together, we can offer no suggestions as to anodizing in bulk.

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For quick, inexpensive cleaning of oils, waxes, greases, etc. from metal stampings, die-castings, screw machine parts, the Wallace DG-1 Vapor Degreaser is unexcelled. No plumbing required for installation; easy plug-in operation makes it available to many departments in larger plants for "on-the-spot" cleaning.
Incorporates all the features, *plus*, at a fraction of the cost of large units. Low-priced within the budget of the smallest shop.

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(*Concluded from page 77*)

Electronic Configuration in Electrodeposition from Aqueous Solutions

II. The Deposition Process

Ernest H. Lyons, Jr.

It is proposed that electrodeposition proceeds through an intermediate complex ion adsorbed on the cathode by a coordinated bridge. Subsequently, the bridge is eliminated and a metallic bond established. By applying the Pauling theory of the metallic state, the reversible deposition of post-transition metals and irreversible deposition of the transition metals are explained. A close correlation with electron-transfer reactions is shown. Inclusions in deposits represent residual coordinated groups, in agreement with the results of recent studies.

Electronic Configuration in Electrodeposition from Aqueous Solutions

III. Deposition from Certain Metal Complexes

Ernest H. Lyons, Jr., John C. Bailar, Jr., and Herbert A. Laitinen

The cathodic behavior of cobalt, nickel, copper, and zinc complexes of 8-hydroxyquinoline-5-sulfonic acid, 1,10-phenanthroline, glycine, naphthalenediamines, tetramethylethylene-diamine, and dimethylglyoxime was investigated by determining cathode efficiencies and polarograms. Deposition was not obtained from ions believed to have hybridized orbitals involving the penultimate electron shell, that is, from the "inner orbital" complexes of Taube. Deposits were obtained from "outer orbital" ions, thus confirming the rule previously proposed. Evidence is given that copper, as well as cobalt and nickel, forms ions of both types.

The Interaction of Organic Compounds with the Surface During the Electrodeposition of Nickel

Clayton C. Roth and Henry Leidheiser, Jr.

Correlations were drawn between the structures of 76 organic compounds and their effect on the cathode potential. Brittleness, peeling, and cracking of the deposit occurred at high cathode potentials. Adsorption experiments with Raney nickel and measurements of the electrode potential in 1*N* HCl indicated that the compounds most effective in increasing the cathode potential were readily adsorbed by nickel. X-ray measurements indicated that the compounds which affected the potential also interfered with crystal growth.

Role of Shape of Colloidal Molecules in Electrolytic Metal Deposition

S. Levy

The changes in electrolyte at the cathode caused by two types of colloidal molecules are discussed. Specific mechanisms of influence on electrodeposits are suggested for each type: elongated and spherelike molecules.

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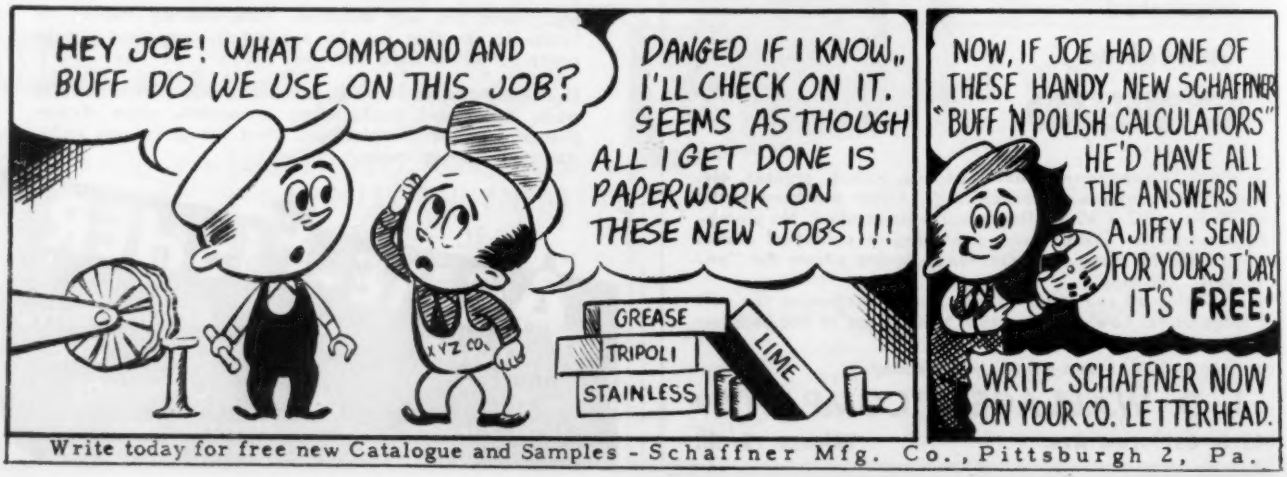
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